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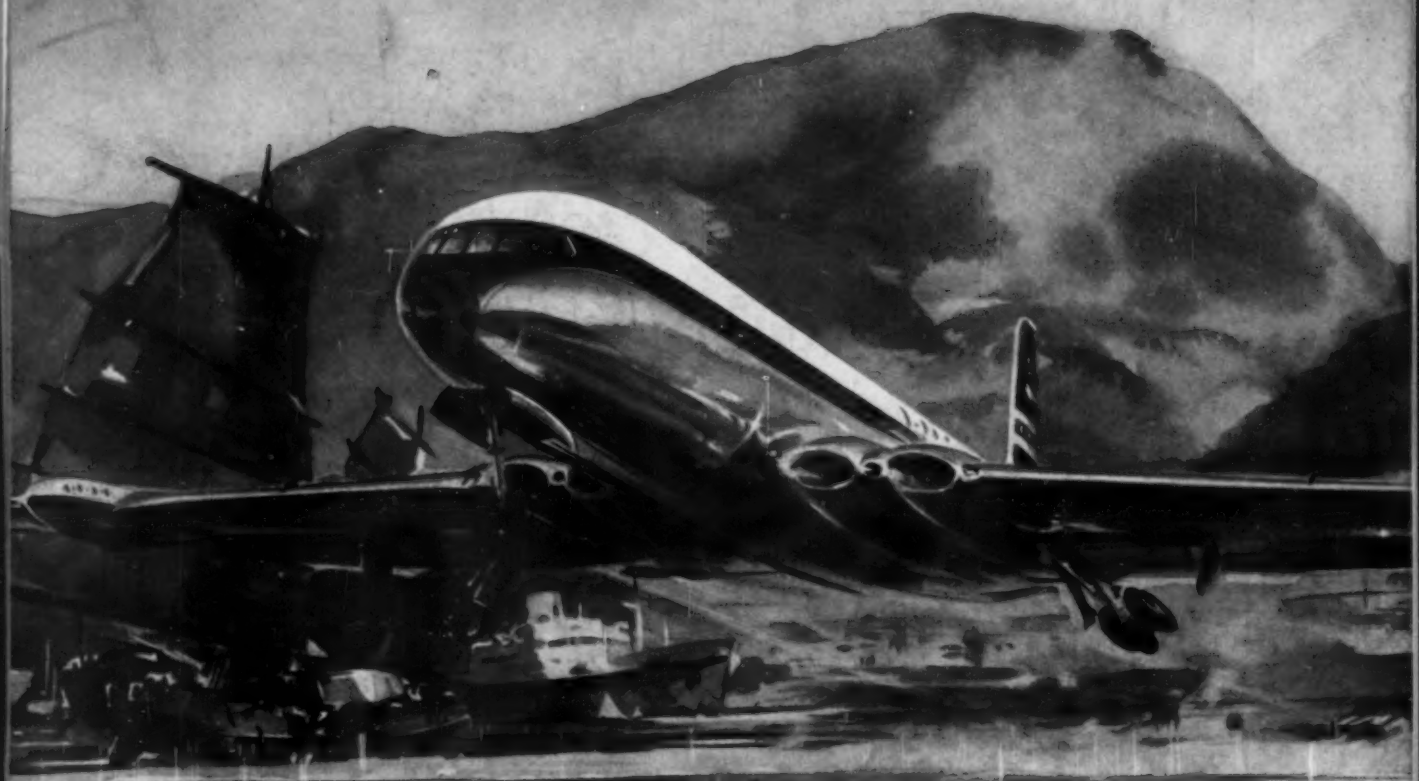

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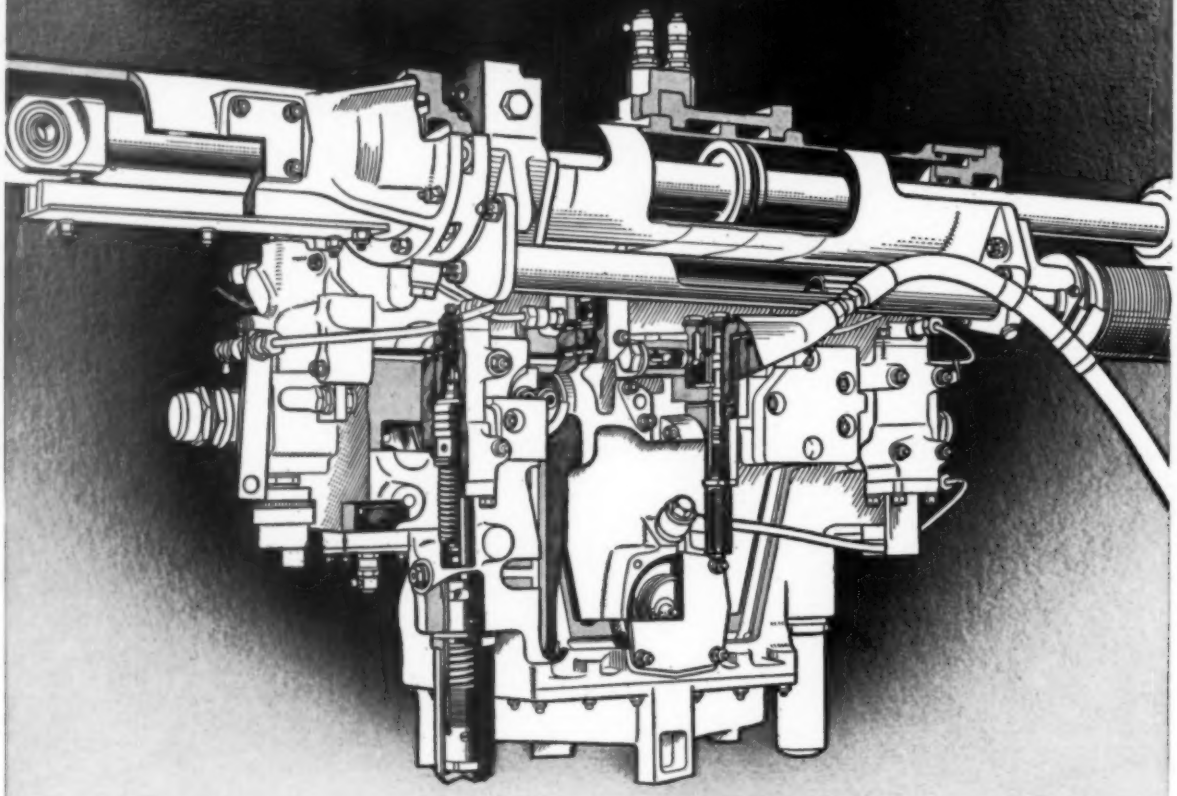

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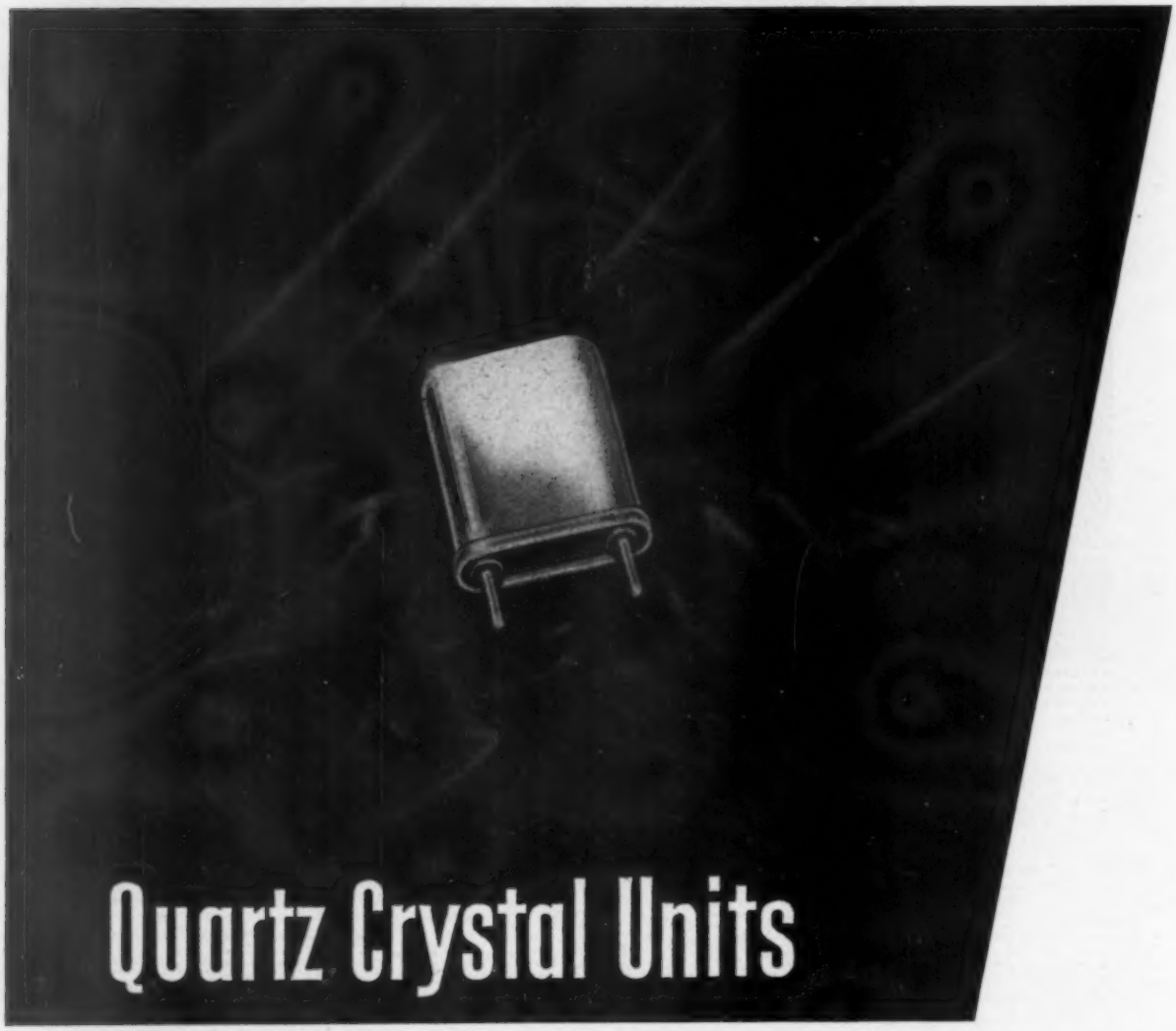

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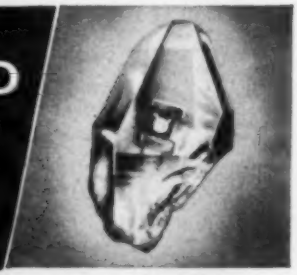

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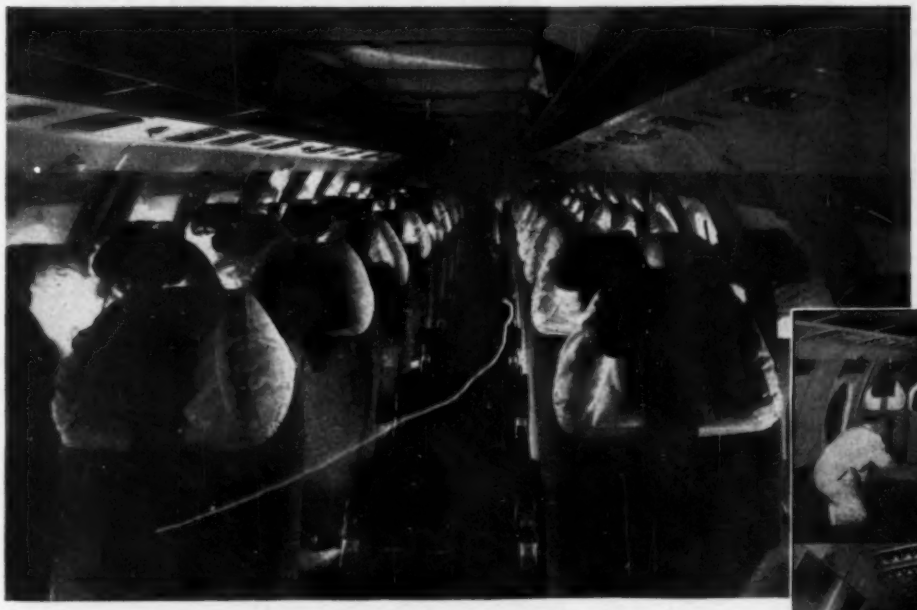

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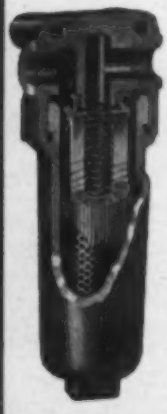

On the right is shown part of the pleated paper 'Micronic' element

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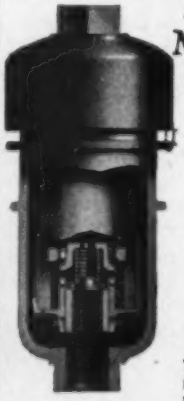

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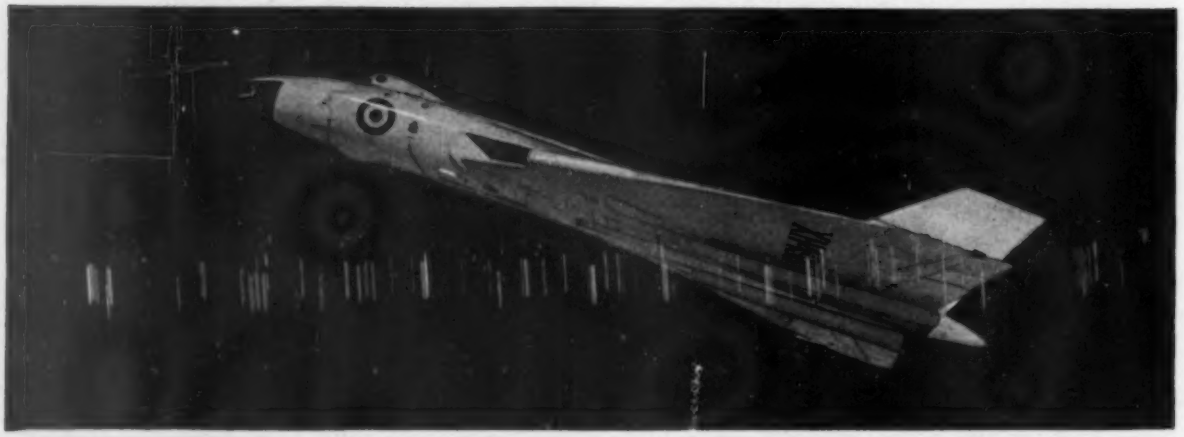

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and
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After the Lightning?

WHEN the Chief of the Air Staff launched a guided bottle of Moët et Chandon at the nose of an English Electric Lightning intercepter at the Royal Aircraft Establishment on Thursday of last week he did more than put an official "handle" (as he termed it) on this mighty fighting aeroplane. He set the seal of R.A.F. approval on a weapon system which, in the belief of its constructors, will continue to be developed and operated for ten years.

This does not necessarily mean that the Lightning, or one of its derivatives, will be the ultimate R.A.F. fighter. That particular point will remain exposed to conjecture and contention for some time to come. But it does mean that when the Government reached the conclusion that the R.A.F. were unlikely to have a requirement for fighters more advanced than the Lightning, and cancelled work on later projects, they were pretty certain that the R.A.F. had in that aircraft not only a winner but a stayer.

Nor will airframe improvements alone augment the potency of the Lightning weapon system. The de Havilland Propellers Firestreak missiles that are its main armament today are amenable to development; indeed, it was officially announced at the R.A.E. the other morning that the Lightning is "large enough to accommodate the more advanced guided missiles which are now being developed, and their associated equipment."

Whether or not this amazing aircraft will ever have a completely new successor one thing is clear; and that is the delicacy of the "last or not" argument. With developed airframe, engines and armament, and perhaps another seat and a few other items that English Electric and their associates Ferranti and Marconi might feed into the weapon system, the Lightning FAW.5 (let us say) might be sufficiently transformed to justify a change of name. It would only need another bottle of champagne to prove that the Lightning is not the last manned fighter for the R.A.F.

Tomorrow Can't be Bought

AFTER receiving the Franklin Medal for 1958 that great American, Donald W. Douglas, chairman of the company that took his name thirty-eight years ago, delivered himself of some debatable sentiments. He declared that whereas the ideologists and politicians were making the headlines of today, it would be the engineers and scientists who would write the history of tomorrow; and he advocated that the U.S. Government should consider establishing an award system, possibly patterned after the Nobel Prizes, but "recognizing more categories germane to the space age." He took note that "in the case of Sir Frank Whittle, credited with perfecting the jet turbine engine, the British Government not only honoured him with a knighthood but provided him with a very substantial tax-free honorarium."

It emerged, however, that in advocating these prizes for "the real inventors and innovators" Mr. Douglas was viewing the payments not so much as rewards but as incentives to keep America ahead of Russia, where professional people receive special social and economic concessions (Andrei Tupolev and other Soviet aircraft designers have been voted large tax-free grants). Thus the scheme itself could become a sort of political carrot.

While few people nowadays believe that genius really flourishes best in a garret (and some even doubt if the true mother of invention is necessity), we are nevertheless filled with misgivings about Mr. Douglas's proposals. Could it come to pass that the lodestone of the future will prove to be merely the dollar, or the rouble, or even the pound sterling? We do agree with Mr. Douglas that the ideologists and politicians may well be ousted by the scientists and engineers; but these last must surely be motivated by some principle transcending self-interest or even national interest. They will be seeking something over the rainbow. And it will not be a crock of gold.

FROM ALL QUARTERS

Delta Bravo's Royal Passenger

LAST Tuesday, at 4 p.m., the Duke of Edinburgh was due to leave London for Ottawa in B.O.A.C.'s Comet 4 G-APDB, with Capt. T. B. Stoney in command. The flight-plan provided for an 11-hour journey, with a 70-min refuelling stop at Gander.

The Duke's return flight, terminating at R.A.F. station Leuchars, is being made tomorrow, November 1. In the interim G-APDB will carry out routine crew-familiarization flights from Ottawa and New York.

The aircraft interior has been specially modified for the trip, with a dining saloon forward, sleeping quarters for the royal passenger amidships, and sleeper seats in the after cabin.

Airlift from Jordan

IN the airlift of some 2,000 British troops and R.A.F. personnel from Jordan which began last Friday, R.A.F. Beverleys and Hastings of the Middle East Air Force were used for the Jordan - Cyprus stage and Hastings of Transport Command and Shackletons of Coastal Command for the homeward route from Cyprus to R.A.F. Lyneham. Operations on the Jordan - Cyprus stage were expected to continue until last Wednesday (October 29), the aircraft flying on a route over Syria prescribed by U.N. observers. Only one "incident" was reported, pilots of Beverleys saying they had been intercepted over Syria by Migs of the Syrian Air Force —which, however, "dipped their wings in recognition and then veered away."

F-104s for the Luftwaffe

AFTER the most protracted evaluation of a military aeroplane in recent times (extending over some two years), the West German Defence Ministry has selected the Lockheed F-104 Starfighter for the Luftwaffe. The most recent types of F-104 produced by Lockheed's California Division are the 104B two-seat tactical intercepter and strike aircraft, and the single-seat 104C all-weather fighter/bomber.

It is understood that the final signing is dependent upon satisfactory completion of arrangements for manufacturing in Western Germany the bulk of the 300 aircraft involved; the consortium which would do so has not yet been divulged. From six to ten Lockheed-built machines will be purchased first, the value of the entire contract being quoted at DM1,200m (£102m), representing the surprisingly high figure of £340,000 per aircraft (and, presumably, spares).

Free Flight by the SC.1

ON October 25, the Short SC.1 experimental VTOL aircraft made its first hovering flight away from the tethering gantry at the Short Brothers and Harland airfield at Sydenham, Belfast. The pilot was Mr. Tom Brooke-Smith, the company's chief test pilot.

The SC.1 started its taxying trials at Sydenham in December 1956 and the following April it flew as a conventional aircraft at Boscombe Down on the power of the single Rolls-Royce RB.108 mounted in the tail. Later the four lifting RB.108s were added and tethered hovering began in the gantry at Sydenham last May. Last Saturday the machine hovered at about 30ft and made tentative probes in the horizontal plane before alighting. The behaviour of the aircraft, powerplants and automatic control system was satisfactory, and the way is now clear for further exploration leading to full transition.

FREE ASCENT: First free vertical take-off by the Short SC.1 Rolls-Royce-powered VTOL research aircraft at Belfast on Saturday, October 25 (news item on this page)

Croydon Meetings

AT a meeting on October 22 between the Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation (Mr. Airey Neave) and the Croydon Airport Users' Association, the latter explained the "great difficulties" they saw in accepting the Ministry's offer of limited facilities at Biggin Hill after the destined closure of Croydon on December 31.

Mr. Neave promised to report these representations to the Minister (Mr. Harold Watkinson), who was due to receive a deputation from the Royal Aero Club last Tuesday, October 28.

First meeting of the Standing Joint Committee on Private and Club Flying and Gliding, the new M.T.C.A. advisory group whose chairman is Mr. Neave, took place last Friday, when methods of working and future programme were agreed.

Brockworth to Shut

SOURCE of nearly all the Sapphire turbojets in R.A.F. service, the Brockworth plant of Armstrong Siddeley Motors is to be closed and returned to the Ministry of Supply. The decision will become effective in about twelve months' time. The entire Hawker Siddeley Group is steadily being reorganized, and aero-engine production will be concentrated at the A.S.M. plants in the Coventry area. This reorganization in no way affects the Bristol-Siddeley consortium, which has been in existence for six months.

Loss of Vulcan in U.S.A.

A VULCAN of No. 83 Sqn., Waddington, captained by F/L. J. W. Moore, crashed alongside the Detroit River last Friday during a flight from Goose Bay to Lincoln A.F.B., Nebraska. There were no survivors from the crew, which in addition to F/L. Moore consisted of F/L. B. Peacock (co-pilot), S/L. H. J. Scull, F/L. J. D. Watson, F/O. A. D. Baker and Ch. Tech. E. C. Evison. It had set out on a training flight from Waddington the previous day and was carrying a message from the mayor of Lincoln, Lincs, to the mayor of Lincoln, Nebraska.

The aircraft demolished or damaged houses on the Detroit river-front, but caused no further fatalities. At 35,000ft over Dresden, Ontario, the pilot had requested an emergency bearing to Kellogg Field. He then immediately asked for a bearing to any field. A final "Mayday" call, sent shortly before the aircraft struck a house and disintegrated, reported complete electrical failure. G/C. D. Haig (C.O. of R.A.F. Finningley, who led an R.A.F. investigating team) is reported to have said that the complete electrical failure reported by the pilot could not have been the only cause of the accident.

VIEWING THE SC.1 at Belfast recently were, l. to r.: Dr. A. A. Griffith, chief scientist, Rolls-Royce; Mr. A. A Lombard, chief engineer, Aero Division, Rolls-Royce; Mr D. Keith-Lucas, Short's technical director; Air Chief Marshal Sir Ralph Cochrane, Rolls-Royce; and Mr. G. L. Wilde, Rolls-Royce. The visitors are seen just before departure from Sydenham Aerodrome in Rolls-Royce's Heron

Links with Germany

AS recently reported, the B.M.W. Triebwerkbau company of Munich are anxious to manufacture the Bristol Orpheus and the agreement has now been signed. Licence-production of the Orpheus is also scheduled in India, France and Italy, and an Americanized version has been developed by Curtiss-Wright.

On October 15 is was announced that the United Aircraft Corporation of East Hartford, Connecticut (parent company of Pratt and Whitney Aircraft, Sikorsky and Hamilton Standard) have acquired a 45 per cent interest in the Weserflugzeugbau. This has enabled the German company to increase its capital from DM4m to 7m, and the way is now open to the licensed-production of Sikorsky helicopters—the S-58 in particular.

Balloon Rocket Fails

AN attempt by the U.S. Army to launch into satellite orbit a 12ft diameter balloon from Cape Canaveral failed on Wednesday, October 22, following "some difficulty with the upper stages of the launching vehicle." The four-stage rocket was a modified Jupiter-C; and the balloon, which was constructed of aluminium foil and plastic, was to have been ejected and inflated when the final-stage rocket reached a predetermined height. The balloon would have carried a radio transmitter but no instruments. The object of the investigation was to track the balloon in orbit at about 400 miles and so obtain information on the density of the atmosphere at that height.

Air League Luncheon

APPROPRIATELY—for the luncheon took place in the Mansion House—the Lord Mayor of London, Sir Denis Truscott, T.D., took the chair when, last Friday, the Air League of the British Empire entertained many distinguished guests. The traditional toast of the Lord Mayor, Corporation and the Sheriffs was given by Air Chief Marshal Sir Guy Garrod, and the Lord Mayor replied.

The principal guest and speaker was the High Commissioner for Canada, the Hon. George Drew, Q.C., who, under the title of "Target for Tomorrow," spoke mainly of the past and present of Anglo-Canadian aviation.

R.A.F. Flying by Regulars

IN our account last week of a speech by the Chief of the Air Staff, Marshal of the Royal Air Force Sir Dermot Boyle, at the Nottingham University Air Squadron annual dinner, Sir Dermot was incorrectly represented as saying that whereas a year ago one-third of the R.A.F.'s flying was being done by regular officers, by 1970 only one-sixth would be done by regulars. The opposite is, of course, the case. By 1970 it is expected that the total amount of flying in the R.A.F. will have fallen to about one-half. To compensate for this the Service will considerably reduce the numbers of short- and medium-service aircrew, but the amount of flying carried out by regular officers will remain at approximately the same level as it is today. In fact, the long-term regulars are expected to carry out something like five-sixths of the overall total.

Kolibrie Progress

IN an official statement the Nederlandse Helicopter Industrie say that while it is true that two of their directors have resigned (as reported in *Flight* for October 17), the reason for these resignations was personal. They add that there has been no lack of orders for the H-3 Kolibrie; the first series has been sold and production of the second series has just started. Five H-3s were operating on agricultural duties during the summer and orders (mainly for similar applications) have recently been obtained from Israel, South Africa, the U.K. and New Zealand.

As the Royal Netherlands Air Force already has many helicopters fulfilling a rôle similar to that of the H-3 it has no immediate need for Kolibries; but it has been officially stated that a great number of Army and Navy utilizations are foreseen for the little helicopter.

Demonstrations of the H-3 have been arranged for November 10 and 11 by European Helicopters, Ltd., Ipswich Airport, Suffolk, who are sole U.K. importers and distributors of Kolibrie helicopters.

VOLTIGEUR—or "light infantryman"—is the name of this SE.116 ground-support aircraft. The prototype depicted (with representative loads) is flying with piston engines, but a second machine, with Turboméca Bastan turboprops, should be in the air next month

The Hon. Alan Boyle

WE regret to record that the Hon. Alan Reginald Boyle, A.F.C., younger brother of the Earl of Glasgow and a pioneer British aviator, died suddenly on October 15 at the age of 72.

He took part in the 1910 Bournemouth international meeting, flying the Avis monoplane which he had built himself and which is now preserved in the Science Museum, South Kensington. Unfortunately the machine turned over during a landing on rough ground and Boyle was thrown out, receiving severe head injuries from which he never fully recovered and which put an end to his flying career. He received the A.F.C. for his service as a balloon officer in the R.F.C. in the First World War; from 1932 to 1945 he was president of the Scottish Gliding Union; and he also served as chairman of the aviation committee of the Scottish Council for Industry.

IN BRIEF

Pan American pilot Charles Banfe landed at Idlewild, New York, last Sunday in his Mooney Mk 20 after a 50-day solo flight round the world.

* * *

A Fairey Ultra Light helicopter is on its way to Canada by sea for demonstration to the Canadian armed forces and civil authorities. Lt-Cdr. John Morton will be the pilot.

* * *

A critical analysis of this year's Motor Show, and an appraisal of 1959 design trends, are contained in today's (October 31) issue of our associated journal *The Autocar*.

* * *

The Australian Air Minister announced last Friday that the R.A.A.F. is to equip its Avon-Sabres with Sidewinder air-to-air missiles. The Sidewinder is a product of Philco and G.E., and was originally developed for the U.S. Navy; it has been much used in recent fighting around Formosa.

* * *

G/C. Douglas Bader presented awards and diplomas to students of the College of Aeronautical and Automobile Engineering at a prize-giving ceremony in Chelsea Town Hall last Monday, October 27. The Principal of the College, Mr. J. A. C. Williams, reported that the number of students had increased to 400, of whom 100 were in the Department of Aeronautical Engineering.

* * *

A Spitfire used by Air Chief Marshal Sir James Robb when he was C-in-C. Air Forces Western Europe (British element) is now on view outside the Montagu Motor Museum, Beaulieu, Hants. It last flew in November 1953 and for over three years has been the property of Swandean Garage, Ltd., Worthing; it has been loaned to the museum through the good offices of a director of the garage company, G/C. F. M. Wilcock.

STAFF AND STUDENTS of the Empire Test Pilots' School visiting Handley Page's Radlett factory and airfield on October 15. They included pilots from the R.A.F., R.A.A.F., U.S.A.F., U.S.N. and the Indian and Italian Air Forces, and were led by the Commandant of the School, G/C. R. E. Burns. They heard from Mr. G. Lee, H.P.'s deputy chief designer, about possible future development of the Victor, and they are seen here being addressed at lunch by Sir Frederick Handley Page. On Sir Frederick's right is G/C. Burns and on his left are W/C. E. H. Turner, the C.F.I. of the Test Pilots' School, and Mr. R. S. Stafford, H.P. technical director

On the port side, immediately behind the flight deck, is a congenial lounge. The mural on the bulkhead has a balloon theme. Seen at the foot of the page is the take-off for the trip described

Jet Clipper

RIDING PAN AMERICAN'S BOEING 707 TO THE U.S.A.

By THE TECHNICAL EDITOR*

PROBABLY nothing has had so much impact on air transport as the advent of what are now generally known as the "big jets." Of these, the first to come into service is the Boeing 707-121 of Pan American World Airways. PanAm recently invited *Flight* to cross the Atlantic in one of these aircraft in order that we might see for ourselves how the patrons of the world's trunk air routes may expect to travel during the next dozen or so years. Relatively few people have so far enjoyed this privilege, but many are aware of the big Boeing's capacity for making noise and smoke; it is therefore with particular pleasure that the writer is able to place on record his appreciation of the very real improvement in passenger comfort and convenience which the 707 provides.

On October 21 PanAm had four of their six -121 aircraft, two with full certification and two without. In the case of the machine in which we flew, the certificate had been awarded only on the previous day. This aircraft was N711PA *Clipper Mayflower*. My acquaintance with it began at London Airport, as I waited for the monster to arrive from Paris whither it had borne 99 American journalists on its eastbound crossing. A distant smudge of smoke gradually resolved itself into the streams from the big Pratt and Whitney engines, notwithstanding the fact that the aircraft was then already making its approach. Touching down fairly well up runway 33L, the big Boeing soon settled down and when the nose gear was properly on the runway the air brakes were opened and full thrust-reverse applied.

The crew of thirteen comprised Captain Scott Flower, assistant chief pilot (technical) of the Atlantic Division, in command; Captain Richard Vinal, assistant chief pilot (technical) of the Latin American Division, first officer; Captain D. Kinkel, navigator; E. Blackburn, check navigator; Charles Corey, flight engineer; Fred Deckwitz, Raymond Rodrigues and Donald J. O'Keefe, pursers; and stewardesses Elizabeth Ganz, Georgette Henriod, Helen Jones, Ursula Markert and Jane Noel. A flight plan had been filed with a refuelling stop at Keflavik, Iceland, and the stage-length of 1,200 statute miles was short enough to permit a take-off at appreciably less than the certificated weight of 247,000 lb. When the aircraft had been fuelled and serviced I went on board by the aft door and chose the rearmost window seat, affording a perfect view of the plurality of pods, pylons, gear, flaps, high-speed and low-speed ailerons and spoilers.

It was while climbing the gangway that we received an impression that was to stay with us throughout our acquaintance with the aircraft: the 707 is really big, having a fuselage volume roughly twice as great as that of any contemporary four-engined airliner in service. From top to bottom the hull measures 14ft 2½in; the maximum width is 12ft 4in and the usable length is 104ft 8in. The interior was laid out almost exactly according to the detailed cut-away drawing produced for *Flight* of July 25 last. Four-abreast first-class seating was arranged back to the rear spar of the wing, aft of which were eleven rows of six-abreast economy seating at 34in pitch, followed by a triple and a double unit to port.

As is now well known, Boeing chose to use relatively small (12½in high×9in) passenger windows; but the fact that there are so many of them seems to afford complete compensation, and visibility is likely to be adequate for all except those passengers who may wish to look to the front or rear at an acute angle. From the passenger's viewpoint, the wing appears surprisingly small.

The powerplants, which in *Mayflower* are JT3C-6s, are spaced very widely, the distance from the aircraft centre-line to the inners and outers being respectively 27ft 2in and 46ft 1in. Starting is effected by an AiResearch fuel/air combustion unit geared to the high-pressure section of each engine. Engine No. 3 is started first, the air supply for the starter being taken either from internal 3,000 lb/sq in bottles or from a low-pressure ground cart. The latter method was employed at London Airport, and, in spite of its marginally low delivery at 35 lb/sq in, engine No. 3 picked up promptly at 1255 hr with a pleasant Viscount-like hum. Once No. 3 was started, its air was bled to feed the starters of the remaining three engines and all four were turning within 90 sec. A modest surge of power then sufficed to get the great aircraft in

**Who also took the photographs, with the exception of that reproduced below.*

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The specific fuel consumption of the initial production Rolls-Royce Tyne prop-jet engines will be 0·405 lb/t.e.h.p. hour cruising at 25,000 feet, 370 kt., ISA, a figure comparable with the most highly developed piston engines.

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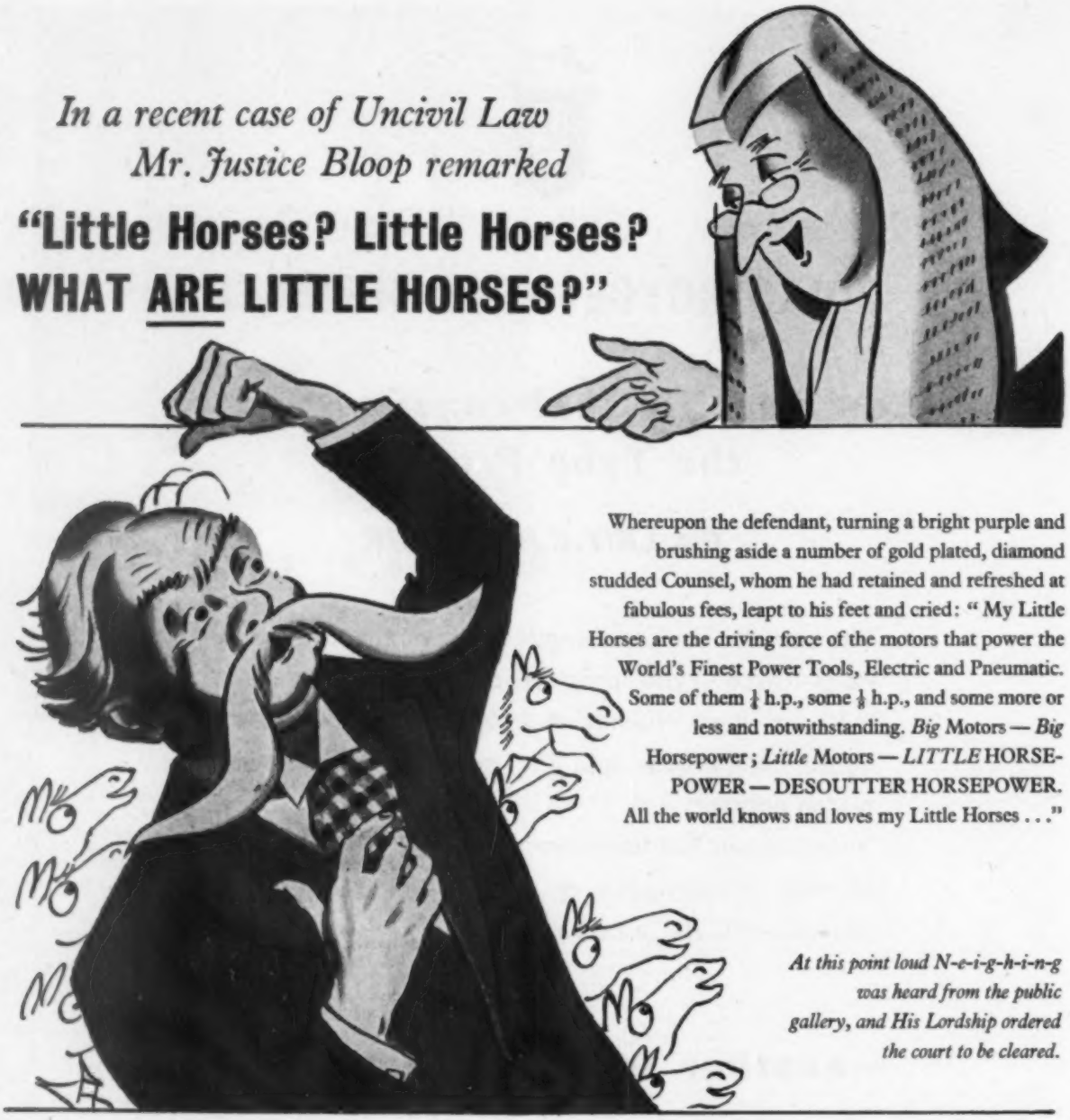
In a recent case of Uncivil Law
Mr. Justice Bloop remarked

"Little Horses? Little Horses? WHAT ARE LITTLE HORSES?"



Whereupon the defendant, turning a bright purple and brushing aside a number of gold plated, diamond studded Counsel, whom he had retained and refreshed at fabulous fees, leapt to his feet and cried: "My Little Horses are the driving force of the motors that power the World's Finest Power Tools, Electric and Pneumatic. Some of them ¼ h.p., some ⅛ h.p., and some more or less and notwithstanding. *Big* Motors — *Big* Horsepower; *Little* Motors — *LITTLE* HORSEPOWER — DESOUTTER HORSEPOWER. All the world knows and loves my Little Horses . . ."

At this point loud N-e-i-g-h-i-n-g was heard from the public gallery, and His Lordship ordered the court to be cleared.

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Capt. Scott Flower (left) is one of the most experienced airline pilots in the world, having served PanAm for 22 years. He has been flying the 707 for many months and finds its demands less critical than his expression might suggest

PODOGRAPHY

The three pictures on the right show contrasting passenger views of the finely engineered powerplant nacelles. Each houses a Pratt and Whitney JT3C-6 engine, with a wet rating of 13,200 lb, fitted with a 21-tube nozzle and production-type thrust-reverser

Although the interior of the economy-class rear cabin may appear the depth of squalor, it is actually—in the writer's opinion—the most comfortable six-abreast interior yet devised. Much of this stems from the sheer size of the fuselage

Jet Clipper . . .

motion, and also to emphasize the excellent handling of the two-spool Pratt and Whitneys.

As we taxied out to the eastern end of 28R, Capt. Flower wound on 30 deg of flap, the ends of the jack-screws spinning merrily in full view. At the same time the leading-edge flaps inboard of the outer pylons were depressed, to provide maximum lift at the high angle of attack needed to get the aircraft off the ground. At 1304 hr he stabilized the engines at their full thrust of 13,200 lb each, with injection of chemically-pure and filtered water (no methanol). Inside the aircraft the feeling of power was immense, and the 21 nozzles of each powerplant streamed thunderous jets of smoke which billowed away astern. When the brakes were released, the acceleration, although by no means fierce, was sufficient to dislodge something in one of the pantries.

Mayflower broke ground after 38 sec at a weight of 211,000 lb, having probably used some 6,000ft of the available runway. At once it was pulled up into a firm climb while the gear was retracted and power was cut back (with water switched off), and before the 500ft level was reached the flaps were being inched into their fully home position. The profile has been carefully planned to minimize the noise nuisance while ensuring that the rate of climb is maintained at the highest level (and always positive).

Quickly clawing our way up through thin cloud, we emerged into bright sunshine and a blue sky, and proceeded to climb on track for Prestwick at 415 m.p.h. At 1317 we had reached 22,000ft and, as we passed a contrailing fighter high above, Capt. Flower estimated the time of arrival at Keflavik as 1535 G.M.T. By 1329 the Boeing had settled down to a steady cruise at 590 m.p.h. T.A.S. at 32,000ft, but already headwinds were beginning to make their unwelcome presence felt. It was obvious, in fact, that no records would be broken on this trip, and the mere fact that Keflavik had been chosen boded ill for our overall time.

Released from the embrace of the thin nylon lap-strap, I examined noise-levels in different parts of the interior. Up front the noise was almost entirely aerodynamic, as might be expected, but the level was perhaps slightly high considering the clean entry of the nose. Further aft one found mixtures of mechanical noise, transmitted through the centre wing, leavened by noise from the engine intakes; behind the trailing-edge the aircraft was extraordinarily quiet, and even at the extreme rear the jet blast was quite inoffensive. The riding of the big ship was superb, and although localized turbulence could cause substantial sudden flexure of the airframe, the strength and flexibility of the Renton-built structure is such as to generate a feeling of confidence.

A personal assessment of the interior trim is "austere." The dominant colours are Pan American shades of pale blue and grey, unrelieved by any local splashes of colour or geometric designs. The concealed lighting is justifiably renowned, and in lieu of curtains the windows have vertically sliding fabric blinds. Beneath the baggage racks are positioned passenger-service units, the spacing of which can be adjusted to suit the seat pitch according to the configuration chosen. Each unit incorporates a drop-out emergency oxygen set, an array of individually-controlled reading lights and cold-air punkah louvres, stewardess-call buttons and the "Fasten seat belts, no smoking" exhortation in incredibly small letters—so small as to be unreadable, one imagines, by passengers with indifferent eyesight. These modular units were of more compact design than those fitted to the original 707 mock-up displayed several years ago in New York City. The seats—particularly the triple economy-class units—were extremely comfortable, although the economy-size ashtrays were obviously not intended for passengers likely to afford cigars.

Established in its cruising configuration, *Mayflower* moved about its three axes almost imperceptibly under the restraining hand of the Bendix PB-20D autopilot. At 1505 hr a sudden spell of rough air set the nacelles nodding a matter of two or three inches at a time, while the hard-pressed cabin staff, used to DC-7C equipment, strove manfully to minister to the needs of 112 guests. Superficially, at least, they were much busier than their more highly paid colleagues up in the bows.

A curious phenomenon noticeable at this time was that each of the big Pratt and Whitneys was likely to emit a gout of black smoke at irregular intervals, so that from the ground we must have seemed to be proceeding through accurate anti-aircraft fire. Usually the smoke puff was dense black carbon, but the entertainment was increased by thick grey-white variations sometimes issuing from only five or six nozzle-pipes at a time. No one seemed able to offer an effective explanation for such behaviour, which has been manifest on several other types of turbine-propelled aircraft and can occur without any apparent effect on the running of the engine concerned.

At 1526 hr the engines were shut down to flight-idling r.p.m. The deceleration was appreciable for some 30 sec, at the end of which time the nose was progressively pointed downwards. Still at flight-idling, *Mayflower* rapidly let down through patches of disturbed air and mist. With gentle touches of air brake (all spoiler sections used together) we slipped through the layer of strato-cumulus which covered the North Atlantic. Flown manually, *Mayflower* responded immediately to almost imperceptible move-

Jet Clipper . . .

Passengers go aboard "Clipper Mayflower" at London Airport on October 21. The towering, white-painted fin, with its blue global emblem, is likely to become a familiar sight throughout the world

ments of the high-speed flipper ailerons between the inner and outer flap sections as we bucked our way round the Icelandic shore. The arrival at Keflavik emphasized the little time available for last-minute corrections, the speed over the fence being 136 kt. The touch—no mean impact— occurred a few moments later at 110 kts and a weight of 172,000 lb. Once approximately settled on the uneven and rain-sodden runway, the wheel brakes, air brakes and full reverse thrust joined forces in a roaring welter of smoke, steam and water, until we finally turned off at about 40 kt and rolled through the dismal array of puddles in a strange quietness.

From doors-shut to doors-open the block time was 2 hr 56 min. The air time was 12 min less, giving a mean ground speed of 440 m.p.h., precisely 100 m.p.h. less than the mean achieved true airspeed from the take-off to touch-down—indicative of the ferocity with which the Atlantic can oppose westbound travellers.

It took an hour to take on a capacity load of fuel for the 2,680-mile run to New York International. At 1650 hr we were glad to return to *Mayflower's* warm interior, and when the MATS stairways were pulled away the Boeing's ten wheels were supporting a total weight of 252,000 lb. We taxied out past the hangar of the Black Knights of Keflavik (the 57th F/I. Sqn., U.S.A.F., whose F-89 Scorpions were the subject of a feature article in *Flight* for February 24, 1956), and at 1655 we were aligned on the runway and ready to roll at the certificated limit of 247,000 lb.

Once more came the surge of maximum wet power, and *Mayflower* charged down the runway in a cloud of smoke, spray and steam, past a blur of muffled and deafened onlookers. We broke ground finally after a time officially quoted as 47 sec (my stop-watch recorded 52) and Capt. Flower pulled the big ship swiftly away across the breakers on the seashore. Soon we were settled into a climb to 24,000ft on the 1,540-mile leg to Goose, and the clicking of 112 lap-straps being unlatched invited me to go forward and see how the big Boeing flew.

I was curious to know why the low altitude of 24,000ft had been chosen, and learnt that this was, in fact, a genuine compromise between air miles per pound of fuel, wind velocity and certain other factors. The climb-out is naturally a function of gross weight, and with any normal weight it is possible to go straight up to around 26,000ft and thereafter to start a step-climb procedure if further altitude must be gained. At take-off we had 103,000 lb of fuel on board and 3,860 lb of water. This, sufficient for an endurance of some 8½ to 9 hr, would have to be drastically reduced to bring our weight down to the landing limit of 175,000 lb. Basic operating weight of *Mayflower* was given as 118,000 lb and the structural zero-fuel limit at 163,800. Fuel to the destination was calculated as 82,100 lb, and we then began to study the vast B.707-121 operating manual. The addition of vortex generators has raised the maximum cruise from Mach 0.81 to M=0.82 up to 28,000ft on a standard day. Between the weights of 235,000 and 245,000 lb 85 per cent thrust and an engine pressure ratio of 2.33 will maintain a true airspeed of 470 knots (M=0.79), the consumption of 3,560 lb/hr per engine resulting in a figure of 33 n.m. per thousand pounds of fuel.

By 1806 G.M.T. our true airspeed had risen to 484 kt (M=0.79 in an outside air temperature of −28 deg C) but the omni-present headwind kept our ground speed to a modest 445 kt and our E.T.A. at New York to a local time of 1825 hr (2225 G.M.T.).

It is common knowledge that PanAm do not yet have a contract with the Air Line Pilots' Association for the big jets. Accordingly, the 707s are at present being flown by senior executive pilots, many of whom have not carried passengers for a considerable period. The airline severed with the radio officers' and navigators' unions some years ago, and it is A.L.P.A.'s intention that all navigators shall also be pilots—a view with which the airline does not concur. PanAm have a contract with the flight engineers' union until 1960, and for a limited period believe they can operate their advertised daily service to European capitals—which started last Sunday—with their executive pilots alone. Three certificated aircraft should be available by the time this issue is published.

On the North Atlantic, at least, navigation should present few problems. Standard equipment includes a sextant, Loran, A.D.F., and V.O.R. for short-range purposes, and the Bendix weather radar is also proving a valuable aid. Pressure-pattern flying is much practised, the customary procedure being to fly along a constant pressure-surface, faithfully following its gentle undulations. The radio altimeter indicates the variations in the height of the surface, and it is thus possible to establish an accurate measure of drift. Moreover, the very speed of the Boeing ensures that the drift thus obtained is not historical but is accurate to within perhaps five minutes of time.

The North Atlantic route is generally controlled from Gander, and the intensity of military traffic constrains the 707 to routes and altitudes which may be less than the optimum. Instead of employing a drift-up profile, it is usual to determine the correct weight at which a climb should be started in order to arrive at the top of the "step" at the right weight to cruise at that altitude. The procedure seems to work effortlessly and there was little evidence of undue activity during the 29 min which it took us to reach the 24,000ft level. The wind at Keflavik had been 270 deg, 20 kt, and this freshened to no less than 130 kt at the top of the climb. At 1735 hr the Boeing was riding rock-steady at 63 deg N, 30 deg W, and these positions had changed to 61 deg N, 40 deg W by 1820 hr. Prince Christian was passed at 1839 hr, and 58 N, 50 W was reached at 1913 hr—two minutes behind the original estimate, with a wind now dropped to 280/45 kt.

Goose was reached exactly on schedule at 2011. The wind at this point had veered to 310 deg/35 kt and engineer Corey calculated that 54,940 lb of fuel had been burnt up to this point. An incidental observation was the tiny inclinometer on his table, giving a measure of inches rise per foot run and thus indicating the longitudinal trim of the aircraft.

Up-front the two pilots relaxed, keeping an eye on the Sperry Integrated Instrument System. On the large roof panel was a small plate giving critical speeds; at 240,000 lb the threshold speed was placarded at 161 kt, and the stalling speed at 124 kt, with 50 deg flap or 148 kt clean—figures which make a striking comparison with the 90 m.p.h. maximum cruising speed of PanAm's first equipment (Fokker F.VIIs).

Crossing the tip of Greenland, *Mayflower* was flying westwards just 70 m.p.h. slower than the sun, at a level true airspeed of 580 m.p.h. We learnt that the start at Keflavik had been effected on the internal bottles, the ground cart prime mover having refused to start. Powerplant No. 3 had not picked up at the first attempt, but whined into life at the second, and its turbo-compressor was then bled for engines 1, 2 and 4. The intake for the turbines is immediately above the main engine intake and can clearly be seen in some of the photographs. On the underside of each nacelle is a second subsidiary intake serving the oil coolers for the main powerplant, the turbo-compressor units and the Sundstrand drives for the main alternators. Pressure ratio seems to be a major parameter in powerplant control, engine speed—both h-p. and l-p. sections have their own panel instruments—being left to look after itself until such time as one engine might get too out of phase with its neighbours.

At 2101 hr Mount Joli passed below, four minutes ahead of schedule (wind 310/70 kt), followed 14 mins later by Presque Isle. The wind strength steadily decreased to 25 kt, enabling *Mayflower* to strengthen her position until, when Boston—the first alternate for the segment—was passed at 2151, the schedule had been improved upon by eight minutes. Soon the Grumman airfield at Peconic River, Long Island, appeared. This, with MacArthur Field and Suffolk County A.F.B. (all on Long Island) has been much used by PanAm crews on 707 conversion.

At 2205 (1805 local time), and after warning his guests, Capt. Flower killed excess speed by dropping the main gear, the noise and buffet being commensurate with the emergence of so large and bluff a body into a near-sonic airstream. In order to enter the Idlewild traffic pattern at the earliest possible moment *Mayflower* was pushed over into a steep descent, reaching zero-g for a short period. A brief orbit in the gathering gloom over Lower New York Bay was followed by an approach to Idlewild across rivers of light, flowing at the regulation 55 m.p.h., marking the homeward surge of commuters along the Long Island express-ways.

The final approach was made under true night conditions. A steep curve in preceded the usual unhesitating contact with the ground. A bounce from one leg to the other, and then came the familiar procedure of airbrakes, full reverse and firm braking. Touch-down at 2225 G.M.T. resulted in a flight time of 5 hr 29 min from Keflavik, and a mean ground speed of 490 m.p.h. Door-to-door time was ten minutes greater, giving an overall block time of 9 hr 35 min from London, including one hour spent on the ground at Keflavik.

The big Boeing had been parked next to one of PanAm's fleet of DC-4 cargo machines, and the changes wrought in transport design in the short 14 years separating their first flights was truly remarkable. As we regretfully left *Mayflower*, Pan American's New York manager said, "I think we will make some money with this ship." I was hardly in a position to disagree.

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Where Elephants Fly

THE STORY OF NIGERIA'S AIRLINE

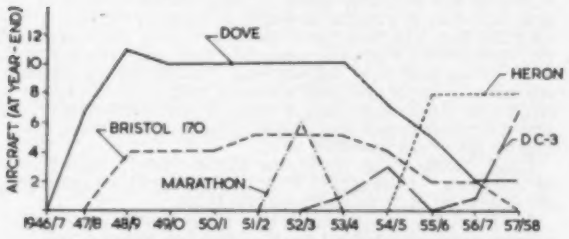
By JOHN SEEKINGS

THE symbol of air transport in Nigeria, indeed throughout West Africa, is an airborne elephant bearing the inscription W.A.A.C. When air services were about to begin in 1946, and an emblem was required, a public competition was arranged; the winning design was contributed by the American wife of a local agricultural research officer.

Few airlines have adopted such a democratic procedure for choosing an emblem. Even fewer have more appropriate insignia, for "the flying Jumbo" has in many ways reflected the character of the airline whose name it bears: it has been the subject of regular controversy; almost every newcomer to West Africa has initially wished to see it altered, but—with a finer appreciation of local conditions—has usually come to accept it; and as a portrait of a creature traditionally antipathetic to flight, it is a fitting symbol of the immense problems facing an airline on "The Coast."

Air transport was slow to take root in British West Africa. Survey flights covering the route between the Guinea coast and Khartoum—where connection could be made with Imperial Airways' services to southern Africa—had started with the so-called Sahara Overlanders using Vickers Victorias as early as 1925, but it was not until 1935 that airfields had been constructed at Lagos, Kano and Maiduguri, and Imperial Airways' service between Nigeria and Sudan was inaugurated the following year.

Arrival of the 14-seat D.H.86 was heralded in spectacular fashion, the Emir of Kano staging a full-scale *Jafi*. A hundred



DC-3s and Herons have now replaced the Doves and Bristol 170s

horsemen, clad in chain mail and with black ostrich feathers waving in their helmets, thundered across the airfield, halted suddenly within a few yards of the aircraft, and delivered a thunderous shout of welcome to the visitors—who were by then concealed in a dense cloud of dust.

In the next two years the service was extended along the coast from Lagos to Accra, Takoradi, Freetown and Bathurst, a Short Scion being used on these new sectors. This once-weekly U.K.-West Africa service continued to be operated by Imperial Airways on behalf of Elders Colonial Airways right through to 1940. From then until 1945 the Mediterranean was virtually closed, and the European connection was re-routed *via* neutral Lisbon, services being operated by Short C- and G-class flying boats, by Catalinas and, later, by Boeing 314s. These services constituted the western half of the "Horseshoe Route," the eastern section of this vital supply-line stretching to the Middle East and on to Australia and the Far East.

During these years the question of post-war civil development was not forgotten. In 1944 Lord Swinton, then Resident Minister in West Africa, appointed the Sandford committee to investigate the matter and the British Ministry of Civil Aviation and the Colonial Office both conducted surveys in 1945. In the following year the West African Council recommended that a West African Air Transport Authority be established, and that the four colonial governments should jointly finance a corporation to operate and develop air services within and between Nigeria, the Gold Coast, Sierra Leone and the Gambia.

Development of W.A.A.C. By this time services were already under way. B.O.A.C. had in 1944 substituted DC-3s for flying-boats on the Horseshoe Route and continued to operate a commercial service through West Africa until mid-1946, when withdrawal of R.A.F. personnel led to the breakdown of meteorological services. After a lapse of a few weeks B.O.A.C. put nine-seat Haltons on to the coastal route, but these were soon replaced by a York service across the desert, Dakar continuing to be served by B.S.A.A.'s services to South America.

Withdrawal of the R.A.F. from West Africa had also led to suspension of the twice-weekly DC-3 "bush service" that Transport Command had since 1944 operated from Accra to Lagos, Port Harcourt, Enugu, Jos and Kano, returning direct to Accra *via* Lagos. A few months elapsed before the Government of Nigeria re-opened the bush service under the name "Nigerian Air Services," using DC-3s chartered from B.O.A.C. as a temporary measure until W.A.A.C. started to operate their own Doves. Eleven of the latter aircraft were delivered in 1947 and 1948 and took over the internal Nigerian services and the route from Lagos to Dakar that B.O.A.C. had dropped when changing the routing of its U.K.-West African service from coast to desert.

Initially the Doves gave little trouble but from late 1948 an increasing number of minor defects led to an awkward degree of irregularity and a consequent fall in load-factor. Then in the following May one of these aircraft crashed in the Niger delta, causing the deaths of all six passengers and two crew on board. After this disaster all the Doves were temporarily withdrawn, services continuing with two Bristol Freighters on charter from West Africa Command and two Bristol Wayfarers on hire-purchase from the British Ministry of Civil Aviation. The austerity of the Freighters rendered them unsuitable for most W.A.A.C. services, and as the Doves returned to operation the Freighters were put on to second-class services in a 56-seat configuration. This so-called "Flyer" service initially operated from Accra to Kumasi but was later extended to Lagos, Port Harcourt, Benin, Tiko and Kano. The Doves were now concentrated on internal services in Nigeria and the Gold Coast while the two Wayfarers operated the 4,000-mile route from Khartoum in the east to Dakar in the west.

A fleet of six H.P. Marathons had been ordered in 1948 but recurrent delays in their delivery led to the need to purchase a Wayfarer early in 1952 (bringing the Bristol 170 fleet up to five aircraft) to cope with the rising traffic on second-class services. The Marathons were eventually delivered through the winter of 1952-53 but towards the end of 1953 it became apparent that they were unsuitable for W.A.A.C. Not only did the Marathon, at that time an undeveloped type of aircraft, suffer numerous snags, but the apparent failure of first-class services (for which the Marathons had been earmarked) to expand, coupled with the rapid growth of second-class services, led W.A.A.C.'s Board to decide to embark on a single fare-structure based on the operation of Bristol 170s and Doves. The Marathons were withdrawn from service early in 1954 but by the mid-year it was realized that the Bristols were too big and the Doves too small for traffic needs. The solution decided upon was to place an order for three Herons, and to start disposing of the Doves.

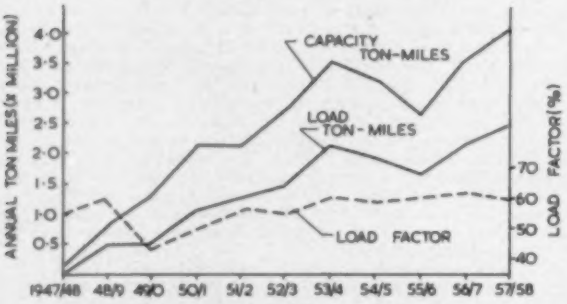
No moment could have been worse than this transition stage for disaster to strike. In February 1955 one of the Wayfarers lost a wing in flight between Enugu and Calabar, all nine passengers and four crew on board losing their lives. Then, two days after Bristol 170s throughout the world had been grounded as a result of the crash, W.A.A.C. was instructed to ground their Dove fleet pending urgent modification. Fortunately a DC-3 had been chartered immediately after the disaster as a precautionary measure and for a few weeks this was the airline's sole operational aircraft. Four more DC-3s and a Viking were chartered on a short-term basis at the time of the Queen's visit and the Heron order was increased to eight. These were delivered early in 1956 and so the short-term hire agreements were terminated and the two Bristol freighters that had been chartered from West Africa Command since 1948 were restored to full-time Army service.

Where Elephants Fly . . .

Continued traffic growth called for increased permanent capacity and W.A.A.C.'s experience with chartered DC-3s convinced the airline of the suitability of this aircraft for use in conjunction with Herons. Accordingly seven DC-3s were acquired in 1957, the fleet being rationalized by sale of the remaining two Wayfarers and of another Dove, leaving only two Doves for government survey and contract charter work (one Dove was recently lost while on a non-revenue flight). Throughout this year more services have been taken over by the DC-3s and it is probable that next year will see disposal of most of the Herons, leaving W.A.A.C. with a single aircraft type for all their internal and regional routes.

Route Pattern. While these many changes have been going on the basic pattern of W.A.A.C.'s route network has remained stable. Lagos, the federal capital of Nigeria, has always been the centre of operations. From it radiate services westbound to Dakar *via* Accra, Abidjan, Robertsfield, Freetown and Bathurst; eastbound to stations in the Niger Delta and on to Tiko lying in the shadow of cloud-bound Cameroon Mountain; and northward to Kano by two routes, either to the west through busy centres such as Ibadan or Kaduna, or to the east *via* Jos.

Accra has always been the centre for local services within the Gold Coast (now, of course, renamed Ghana, after an ancient African empire in the region of Timbuctoo). Kano is another subsidiary base, services being operated down to the Eastern

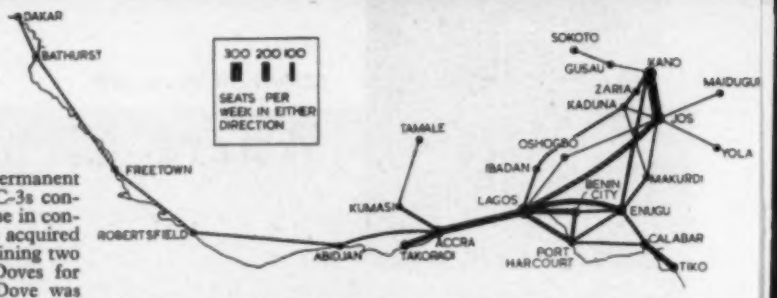


The airline has fully recovered from the 1955 setback

Region of Nigeria and within the Northern Region. The newly created Ghana Airways have recently taken over the internal services from Accra to Tamale, Kumasi and Takoradi. In the near future W.A.A.C. plans to develop a network of local services in Northern Nigeria on behalf of the Federal Government. These will be operated by Beavers or a comparable type, the main purposes of the service being to facilitate administration of a vast lightly populated area ill-endowed with surface communications, and to give Nigerian pilots command experience. This form of operation will not be new to W.A.A.C. for since early this year they have managed Sierra Leone Airways on behalf of the Sierra Leone Government, services being operated with Series 4 Rapides from the capital, Freetown, to various points in the relatively inaccessible interior.

External Services. Only recently has W.A.A.C. really made a strong effort to exploit fields outside West Africa. For a number of years a service was operated from Lagos through to Khartoum. It had been introduced in 1950 at the request of the Colonial Office (to facilitate communications between East and West Africa) but by 1953 it was realized that the meagre traffic did not justify the heavy losses involved, so the service was withdrawn.

West Africa's main connection with the outside world (and that tends to mean Europe) has in the past been through B.O.A.C. In the immediate post-war years connection to the U.K. could be made either through Kano or Dakar, but withdrawal of B.O.A.C.'s South American services led to the disappearance of British carriers on the Coastal route until the Airwork/Hunting-Clan "Safari" service was opened in 1954. The B.O.A.C. and Safari services together handled about 18,000 passengers in each direction last year. (The shipping companies, by comparison, carried only about 10,000 passengers in each direction.) A few also travelled to Europe on South African Airways' Johannesburg-Kano-London services operated in association with B.O.A.C. Other West African connections with Europe are with T.A.P. and PanAm to Lisbon, Air France and U.A.T. to Nice and Paris, K.L.M. to Amsterdam and Sabena to Brussels. S.A.A., K.L.M., T.A.P. and P.A.A. also offer connecting services to central and southern Africa. The only eastward connections are by Sabena



The pattern of internal and regional services is seen clearly from this network map. All routes are operated by the Nigerian airline except for the internal services in Ghana

to the Congo and East Africa, and by Air Liban to Sudan and the Middle East.

W.A.A.C. has wisely delayed its entry to these long-distance routes until traffic has built up sufficiently to support the operation of suitable aircraft. Late in 1957 it agreed to charter twice-weekly round-trips London-Lagos from B.O.A.C., using Argonauts, later replaced by Stratocruisers. This charter arrangement will continue for some time, although next year will see Britannias being placed on this route and frequencies probably increased.

Traffic Abroad. Expansion into the long-distance field is already transforming West African Airways as it has already transformed East African Airways. A twice-weekly London-Lagos Stratocruiser service alone represents an annual volume of capacity or load roughly equivalent to all W.A.A.C.'s other services put together. Although unlikely to grow as rapidly as on some other international routes, the traffic on these long trans-desert services displays certain characteristics that render it unusually attractive to an airline. The competing shipping service take so long getting round the bend of West Africa that even the slowest air services offer a handsome time-saving. Furthermore, this traffic is not only prepared to pay higher fares but is unlikely to be unduly tempted by economy-class fares when tied to austere travelling conditions. This phenomenon reflects the predominant types of passenger using the service: those originating in Europe are primarily senior business executives who expect to fly first-class as a matter of course, or company employees (and their families) who have been offered first-class travel as one of the various inducements to encourage their accepting a post in West Africa; and those starting from West Africa are primarily officials who again, as a class, generally tend to be insensitive to fare levels. At the same time, a cheap, austere third-class service would certainly appeal to a class of passenger that is now travelling by sea or not travelling at all.

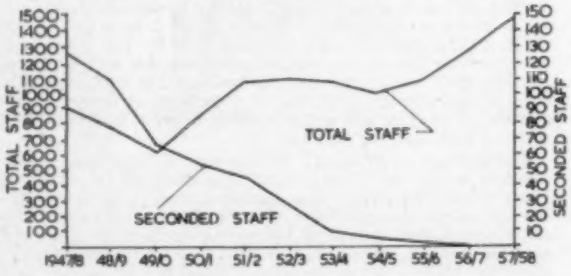
Local Traffic. Past traffic has almost entirely been limited to "the Coast." During 1957 W.A.A.C. carried 80,000 passengers, the equivalent of 25 million passenger-miles.

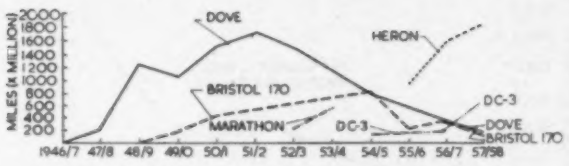
In W.A.A.C.'s earlier years at least two-thirds of the passengers were government officials. As the airline has grown so this proportion has decreased and now stands at less than one-third, almost the entire balance being contributed by business travel. The virtual absence of tourists is a blessing in disguise for, as a result, W.A.A.C. is faced with little seasonal traffic variation.

Another curious feature which renders W.A.A.C. unlike most other short-haul airlines is that its passenger traffic originates not in the lesser towns but in the main centres, such as Lagos, Port Harcourt and Kano. In the U.S.A., by comparison, most local-service traffic is brought in the mornings into the main towns, there to do business, go shopping or catch a connection elsewhere, and then taken out to the lesser centres in the evening.

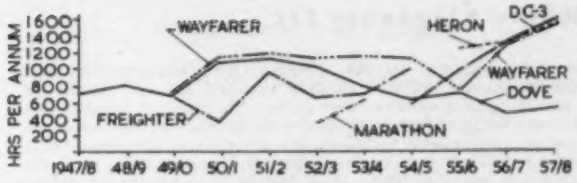
The carriage of mail has always been an important aspect of W.A.A.C.'s activity; indeed, the airline's original policy was "to base the network of local operations on the carriage of mail and to superimpose passenger services on the framework thus provided." In these circumstances it is not surprising that mail rates were high, having fluctuated between 150 and 200 pence per ton-mile since all first-class mail started to go by air in 1950. Internal

All the airline's 1,500 employees are now recruited direct





Annual mileages for each type (aircraft were grounded in 1955)



Utilization rates are now the highest in the airline's history

mail is now charged 5s 6d per kilogram regardless of destination.

Until 1957 the amount of freight carried by W.A.A.C. was insignificant. On no routes was the traffic potential enough to support all-freight services, while the small Doves and Bristol 170s in dense-seating configuration were not suited to carry supplementary freight. Nor have high freight-rates, averaging 50-60 pence per ton-mile, encouraged the growth of traffic. The annual volume of freight fluctuated between one-third and one-half million ton-miles from 1952 until 1956, but has subsequently grown rapidly, the recent increase being largely due to the carriage of newspapers. The encouragement given to newspaper traffic has had an interesting side-effect: the consequent rise in circulation has made the newspapers concerned excellent media for promotion of W.A.A.C. services!

Selling Air Transport in Africa. The airline faces a strange selling problem, its market being split into two quite distinct categories. On the one hand are the hard-bitten professional, managerial and official travellers who need only to be assured of the convenience of flying. To them the fare is of little consequence, but a high standard of service, and reliability, availability of space and sensible schedules, are of the utmost importance. W.A.A.C.'s management is confident that it is already reaching this section of the market effectively, and that the widespread advent of DC-3s will improve the position even further.

But in contrast to this group are those unfamiliar to air transport. There are many—particularly Africans, Syrians and Lebanese—who can afford to fly yet have not yet done so. W.A.A.C.'s first effort to attract this class was the initiation in 1951 of the austere "Flyer" services. Fares were pitched at about 4d. per passenger-mile, the Bristol 170s were fitted for 56 passengers, and an intensive sales campaign was launched. With a theme to the effect that "You Too Can Fly," an exhibition coach equipped with tableaux and microphones was sent touring the country; slides and cartoons were shown in local cinemas; a wide range of new posters was issued; W.A.A.C. calendars were distributed for the first time; people were taken for joy-rides in Bristol 170s; and special give-away badges were presented to all "Flyers." (Originally costing about seven shillings each, these badges—since discontinued—now have a reported black-market price of about £1. W.A.A.C. officials jokingly say they should have stayed in the badge business.)

As a sales effort the "You Too Can Fly" campaign was a great success. Indeed, it was too successful, for in addition to new traffic, those who previously had been flying first-class were also attracted. Early in 1954 the "Flyer" services, by then accounting for one-third of W.A.A.C.'s total load and almost half the total number of passengers, had to be withdrawn (the War Office required the return of their two Bristol 170s) and a one-class fare structure, set at about 10d. per passenger-mile, was introduced. Reluctantly the salesmen had to abandon the more flamboyant media, and concentrate on radio and Press advertising.

In the following year, as a result of the Calabar disaster, a widespread loss of faith in the safety of air transport brought the sales department another severe test. A programme was set up to combat this mistrust, but real success was only realized last year with the advent of the DC-3s.

Since the airline reverted to a single-fare structure in 1954 the fare-level has steadily been increased, and this winter will see Nigerian domestic fares rise further to a shilling per passenger-mile. The fact that traffic continues to grow at such a high fare-level is an indication of the strong demand for convenient air services. W.A.A.C.'s present interpretation of convenience is to offer a minimum DC-3 frequency of one round flight daily on most sectors. To fill the empty capacity that will result from implementing this policy the sales department are now busy promoting round-trip excursion fares valid only on slack sectors. Set as low as 3d per passenger-mile, the excursion fare represents an ace in the hands of W.A.A.C. salesmen intent on winning a game from the bone-shaking "mammy-wagons" that hurtle fearsomely along Nigerian roads.

A perennial sales problem has been that of alterations in schedule. Nothing breaks an airline salesman's spirit more effectively than frequent changes in the services he is trying to sell. In the case of W.A.A.C. most of these changes have resulted from the many equipment difficulties suffered. As the future pattern of operations is now more clearly established, so is the sales programme becoming increasingly effective.

Keeping Aircraft Flying. Those responsible for providing the sales department with marketable capacity have also been dogged by the operational problems of keeping aircraft flying. In a country where the life of a car battery is measured not in years but in months it is obvious that the provision of regular air services is likely to be costly and difficult. A stock West African expression, provoked by human and climatic limitations, is that "If anything can go wrong it will go wrong here."

Although the Gipsy Queen engines now have an overhaul life of 1,200 hours, it was only in 1954—after eight years' experience—that a figure of 1,000 was approved, while the Hercules engines of the Bristol 170s never exceeded an overhaul life of 800 hours (in their last few years of service these engines were overhauled by the manufacturer on an exchange basis). The DC-3s that are becoming the mainstay of W.A.A.C.'s internal services at present have an engine overhaul life of only 900 hr as against B.E.A.'s figure of 1,500 hr. Comparable propeller overhaul lives are 1,200 and 1,500 hr.

Humidity at Lagos is generally in the order of 80 per cent and probably represents the main factor contributing to high maintenance costs. Another factor is the need to provision stores well ahead in order to allow for the long time taken for replacements to reach West Africa from Britain or the U.S. Airlines that find most of their fleet back at base each evening usually maintain at night, but for W.A.A.C. this policy has not yet proved practical. It would demand the installation of air conditioning throughout the shops (at present this is only installed in the instrument and pneumatic sections, although funds have already been allocated to cover the installation of air-conditioning in the other sections). An even more serious objection has been found to be the unwillingness of labour to participate in night-shifts, this being another problem that can only be overcome by considerable expense.

West African Weather. Flying conditions are not as bad as is often supposed. The three most troublesome climatic features are the *Harmattan*, a dry dust-laden winter wind blowing down from the Tibesti area and capable of reducing visibility to a few yards; electric storms with thunderclouds reaching to 20,000ft and winds of 40-50 m.p.h. (gusts of 100 m.p.h. have been recorded); and line-squalls which can extend along a 100-mile

Seen against a typical West African sky at Port Harcourt is one of the Nigerian airline's Herons.

Where Elephants Fly . . .

front to a height of 40,000ft. Fortunately the thunderstorms and line-squalls are normally of short duration and can usually be avoided by appropriate evasive action. Short sectors result in low average flying altitudes: in the dry north this leads to conditions that are unpleasantly turbulent, but in the south (the area of most of W.A.A.C.'s flying) conditions are quite comfortable, a relatively unbroken landscape and a thick coating of vegetation combining to prevent thermal currents from becoming too aggressive.

Flying Aids. Full radio-telephony coverage of Nigeria has only been available since 1956. A few smaller airfields still rely on W/T., this in particular hampering the efficient transmission of meteorological data. Night landing facilities are available only at Kano and Lagos, each of these two airports having D.M.E. and V.H.F./D.F. (voltage fluctuations in the mains supply has led to constant trouble with this equipment). Medium-frequency N.D.B.s are installed at all 18 airports used by W.A.A.C. in Nigeria with the exception of Zaria. A local teleprinter circuit links Lagos with Accra, Kano, Enugu and Port Harcourt, and reliable landline connections serve Takoradi, Tamale, Kumasi, Kaduna, Jos and Calabar. A weak link in the system is Tiko, which is at present served only by W.A.A.C.'s own H.F. R/T. installation. As Nigeria's weather tends to come from the east, Tiko is a particularly important station for the provision of meteorological data.

The absence of night-flying facilities outside Lagos and Kano does not restrict W.A.A.C. as much as might be thought, for it is very unlikely that any significant volume of passenger traffic would be tempted to fly during the hours of darkness. With an operational day starting at 7 a.m. and ending at 7 p.m. throughout the four seasons, W.A.A.C.'s aircraft utilization rates are restricted. The Doves and Bristol 170s never got much above 1,100 hr annually, but the Herons are now over 1,200 hr and the seven DC-3s are approaching 1,800 hr. The route network lends itself to fairly high utilization rates on current equipment, the size of Nigeria and the location of the main bases being such that a round trip on a major route (such as Lagos-Tiko or Kano-Port Harcourt) can just be fitted into an operational day.

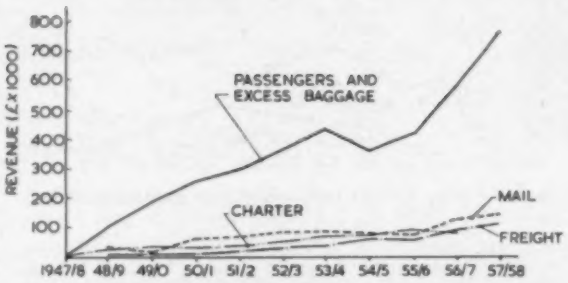
Personnel Problems. W.A.A.C.'s flying crew are a veritable United Nations, hailing from Britain, Australia, Canada, South Africa, Cyprus, Holland, Poland, Iceland and, of course, Nigeria. Crew utilization is high, captains at present averaging over 750 hr p.a., contractual maxima being 1,000 hr per year and 125 hr per 30 days. Leave for flying crew is set at three months every fifteen, and nine off-days must be allowed in every 30. The duty day for captains is set at 16 hr for DC-3 and Heron flights carrying a first officer, and at 12 hr for Herons when only a radio-officer is carried. To achieve high utilization rates in the face of these necessary limitations it is desirable to roster on the basis of 80 hr a month. Operational planning is much facilitated by the absence of awkward traffic peaks and troughs, and by the happy coincidence of block speed for Herons and DC-3s.

It is more on personnel than on aircraft that the hostile West African environment has its most damaging effect. The need to maintain by day, and to allow aircrew an unusual number of holidays and rest days, are only the more obvious symptoms of a problem that besets any business run largely by expatriate staff in the tropics. This is manifest in many directions: members of the staff and their wives get bored with the lack of social and cultural amenities; shortage of accommodation, together with a ban preventing Europeans from owning property in Nigeria, has made it necessary for W.A.A.C. to invest more in houses than in aircraft; many expatriate employees find difficulty in establishing an efficient working relationship with Africans; living on a company estate encourages staff to "talk shop" in their off-duty hours, and many resent this intrusion into their home life; and not all employees on a two- or three-year contract are able to identify themselves closely with the long-term interest of the airline.

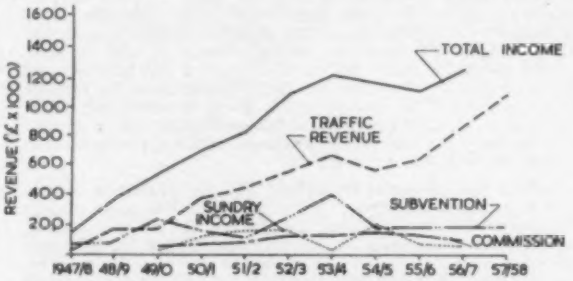
Financial Background. When the environmental restrictions on man and machine are considered together with the airline's obligation to provide certain services which cannot be run except at a loss, it is surprising that W.A.A.C.'s past financial performance has not been worse. For every twenty shillings of revenue earned since the airline's inception, subsidy worth six shillings has been received from the Nigerian and Ghana governments. But the subsidy proportion is falling steadily. Until 1955 the airline's losses were covered by deficiency grants that averaged about one-third of total revenue. Since 1955 a flat annual subvention payment of £200,000 (equivalent to the estimated loss on sub-economic services) has been paid, and these have averaged less than one-fifth of total revenue.

The recent changes in status from a Corporation to a limited liability company will see W.A.A.C.'s capital increase from the present level of £1.6m to £6m. On September 30 the governments of Ghana, Sierra Leone and Gambia (which previously held 29, 2 and ½ per cent shares respectively) withdrew from W.A.A.C., the airline being wound up as a corporation but being simultaneously revived as a company under the name W.A.A.C. (Nigeria), Ltd. The Nigerian government controls 51 per cent of the revised capital, the balance being held by Elder Dempster Lines and B.O.A.C. in the proportion 2:1. Services will continue unchanged except for the internal routes in Ghana, which have been taken over by the recently formed Ghana Airways.

Looking Ahead. A firm financial footing allows the airline to look forward with confidence to the years ahead. Complete national sovereignty for Nigeria, expected to be achieved by 1960, should provoke an increase in the country's air traffic. The tourist industry should develop (the recently appointed Tourist Board is headed by W.A.A.C.'s general manager, Mr. D. Malcolm-Brown), particularly with the construction of hotels throughout the country. But possibly the major factor will be the certainty that responsible Nigerians will wish to see the airline grow. In the same way that T.A.A. and Qantas have acquired great value as a unifying force in a country where national and regional loyalties can pull against each other, so W.A.A.C. will have an essential rôle to play in developing the federal dominion of Nigeria.

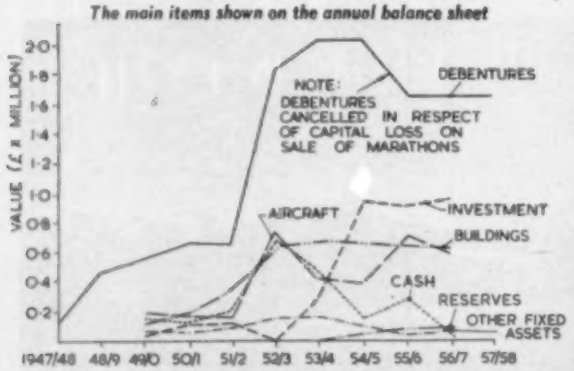


Revenue from all classes of traffic is increasing rapidly

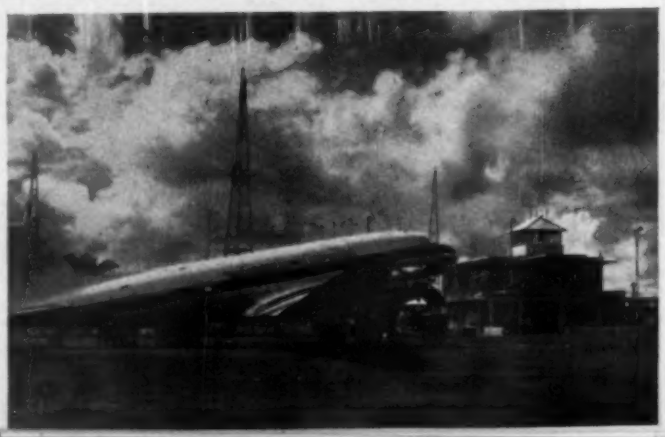


Traffic revenue has almost doubled in the past three years

The main items shown on the annual balance sheet



A DC-3 at Robertsfield, Liberia, on the Lagos-Dakar service



" At its operational height the Victor can outfly and outmanœuvre any fighter in squadron service today "

—AIR MINISTRY

FASTEST TO MALTA

A Royal Air Force Victor bomber has flown from England to Malta in exactly 2 hours at an average speed of 655 m.p.h. This is 67 m.p.h. faster than the previous best flight—by a Royal Navy sonic fighter.

VICTOR in squadron service with the R.A.F.

FLIES ATLANTIC IN 188 MINUTES

A Royal Air Force Victor bomber has crossed the Atlantic in 3 hours 8 mins. It covered the 2,020 miles from coast to coast at an average speed of 644 m.p.h. while flying from Goose Bay, Labrador, to Marham, Norfolk.

HANDLEY PAGE · RADLETT · LONDON · READING

Catching The Airbus?

Turbo-prop comfort at 2d. a mile— and carry your car, sir!

The A.W. 671 Airbus, a variant of the A.W. Argosy freightercoach, will be able to operate over stage lengths of about 200 miles at a direct cost of under 2d. a seat mile. This should greatly ease the economics of operating on ultra-short routes—the routes on which, at present, most operators find it difficult to make any profit at all.

A double decker carrying 126 passengers—30 upstairs 96 down—the Armstrong Whitworth Airbus heralds an era when short-distance air services may run like coaches and trains—regularly every hour.

The Airbus has the same basic fuselage as the A.W. 670 Air Ferry which carries 6 cars on the lower deck and 30 passengers above. Operators whose car ferry traffic is purely seasonal will find it easy to convert Air Ferry to Airbus and vice versa. The spacious hold of this aircraft can, of course, be used for general freighting.

These two variants illustrate the care which Armstrong Whitworth, in planning the A.W. Argosy series, have taken to offer operators maximum flexibility.

Sir W. G. Armstrong Whitworth Aircraft Ltd.
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MEMBER OF HAWKER SIDDELEY AVIATION DIVISION

MAKE THE SHORTEST ROUTES PAY WITH THE A.W. AIRBUS/AIR FERRY

Lox in Service

ADOPTION OF LIQUID-OXYGEN BREATHING BY R.A.F. AND F.A.A.

FOLLOWING the considerable experience of the U.S.A.F. of using liquid oxygen (usually known by the convenient abbreviation "lox") under service conditions, both the Royal Air Force and the Fleet Air Arm have decided to switch to lox breathing systems in certain classes of aircraft. The type of system chosen is that produced by British Oxygen Aro Equipment, Ltd. (B.O.A.E.), and it will be fitted initially in the English Electric Lightning, de Havilland Sea Vixen, Fairey Gannet, Folland Gnat and Supermarine Scimitar.

Lox systems have been standard on U.S.A.F. fighters and bombers for some years, and have been developed to the stage where they offer considerable savings in weight and space compared with gaseous systems. B.O.A.E. is able to take full advantage of this background of experience, because one of the two parent companies whose aviation activities it co-ordinates in the U.K., the Aro Equipment Corporation of Bryan, Ohio, is a major supplier of lox systems to the U.S. Services.

Since B.O.A.E. was formed two years ago it has conducted an extensive research programme into all aspects of liquid- and gaseous-oxygen breathing systems for aircraft. One result has been a progressive refinement of the airborne converters in which the lox is contained, to the extent that a fully-charged 3½-litre converter now weighs only 15 lb, compared with 21 lb when the equipment was first offered over here.

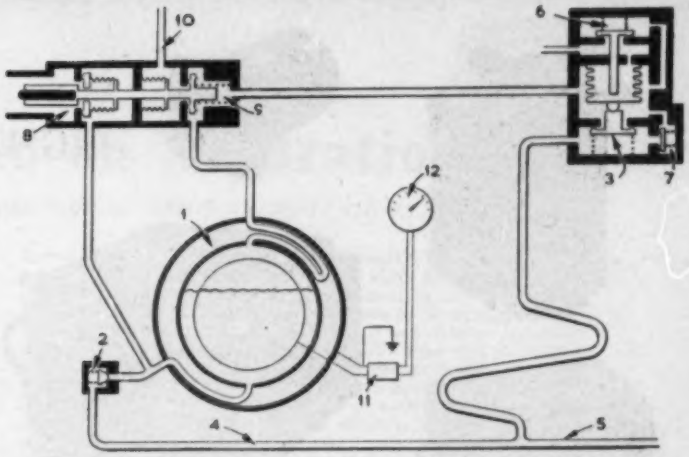
This is the size of converter used in the average day-fighter, providing the pilot with a supply of oxygen equivalent to twice that in present-day installations comprising two standard 750-litre gaseous oxygen cylinders weighing 35 lb. The saving in weight by switching to lox on this class of aircraft is 20 lb (or 57 per cent) and the 3½-litre converter occupies only 0.45 cu ft of space.

The advantages of lox increase progressively with aircraft size, as becomes clear from this table:—

Type of Aircraft	Gaseous Oxygen Cylinders (litres)	Lox Converters (litres)	Weight of Fully Charged Containers (lb.)	
			Cylinders	Converters
Day fighter ...	2×750	1×3½	35	15
All-weather fighter	4×750	1×5	70	20
Light bomber ...	5×2,250	1×15	240	49
Medium bomber ...	7×2,250	2×12	330	80
Long-range aircraft	9×2,250	2×15	415	98

Obviously, the R.A.F. would achieve very worthwhile saving in weight by converting its larger aircraft also to lox; and it is reasonable to assume that any future British military types will be designed from the start to utilize this type of system. Nor is there any reason why commercial aircraft should not follow suit, because if, as seems probable, emergency oxygen supplies have to be made available for passengers of high-flying turbojet types, lox offers a saving equivalent to the weight of two average passengers and their baggage in a 150-seat airliner. This sort of improvement can have a big effect on operating economics.

Acceptance of lox has undoubtedly been delayed by ignorance or fears of its characteristics. The thought of handling a liquid that boils at −183 deg C at atmospheric pressure may seem a little frightening at first; but the ground-charging procedure is so simple that U.S.A.F. servicing personnel now prefer lox to gaseous oxygen.



Operation of a typical airborne liquid-oxygen system. This schematic diagram is explained in the text below

Safety precautions are similar to those laid down for the handling of aircraft fuels and no special clothing is needed, apart from a pair of gloves for protection against frostbite. Converters are re-charged in position in the aircraft, through a hose from a mobile tank, using a self-sealing bayonet coupling. This is less laborious than handling gas in heavy steel cylinders, and as the liquid is stored under low pressure it is, if anything, safer to handle than high-pressure gaseous oxygen. It is also non-explosive and non-toxic.

A diagrammatic layout of a typical airborne lox system is seen above. Here again, there has been considerable refinement in the past year or so, in that electronic contents gauging is now standard in place of the earlier pressure-type, while the filler valve and "vent and build-up" valves are now combined in a single unit.

Converters are, ideally, spherical in shape. But when, as in the case of the Lightning, the system has to be fitted into an aircraft that was designed for a gaseous system, some "squashing" is possible without any marked loss of efficiency. In construction, they are double-shell containers (with a high inter-wall vacuum to keep the evaporation loss rate to a minimum) pressurized to a normal 70-100 lb/sq in. Actual percentage loss figures range from 20 per cent in 24 hours for a 3½-litre converter down to 5 per cent for a 25-litre converter.

Operation of the system is simple, in that liquid is allowed by a check valve to pass into the evaporating coil as required, where it vaporizes and passes to the supply line at the correct temperature and pressure.

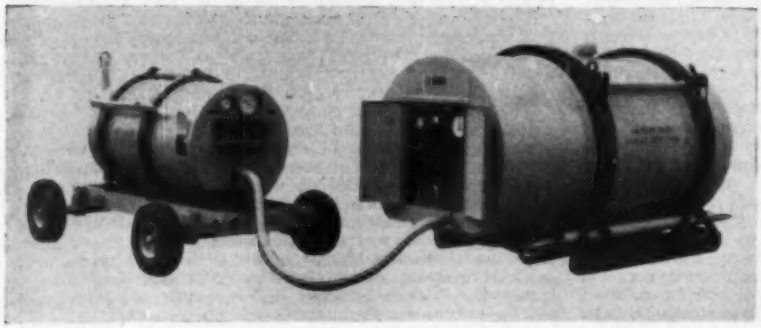
This is shown in more detail in the diagram. The lox is normally prevented from flowing out of the inner container of the converter (1) by the check valve (2). If the pressure in the converter falls below its designed setting the pressure closing valve (3) opens, allowing the pressure above and below the lox to equalize. There is then an excess pressure on the check valve, caused by the liquid head, so it opens and allows some lox to trickle through into the evaporating pipe (4). When this liquid is evaporated by atmospheric heat, the gaseous oxygen passes through the circuit back into the top of the converter, raising the pressure.

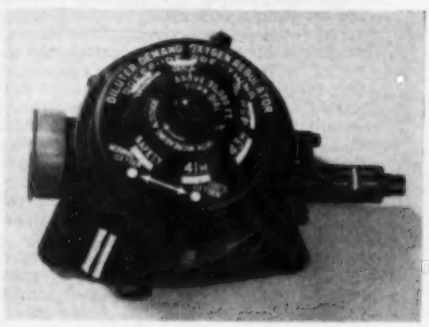
As soon as the working pressure has been restored, the pressure closing valve shuts automatically. Any further lox evaporating in the pipe then shuts the check valve, preventing further outflow of lox.

Operation of the pilot's demand regulator simply reduces the pressure behind the check valve, which opens and allows the lox to trickle out into the evaporating pipe, where it vaporizes and passes to the supply line (5). When demand ceases, increasing pressure again shuts the valve. Excessive pressures in both gas

(*Concluded at foot of page 690*)

Wheel-mounted lox tank (50 U.S. gal) connected by hose to skid-mounted 500 U.S. gal tank. Right, one of the A-series regulators





LIGHTWEIGHT RADIO-COMPASS

Loop, power unit, receiver/control box and indicator of the E-RCB-2

DEMONSTRATED at Southend Airport last week in a Piper Tri-Pacer was a French-designed lightweight radio compass which is to be produced under licence in this country by the radar division of Elliott Brothers (London), Ltd., of Borehamwood. Designed by Air-Equipement of Asnieres, the compass is designated the E-RCB-2 and provides communication reception and continuous automatic indication of relative bearing. The complete system comprises receiver, loop aerial, bearing indicator and power unit, and utilizes M.C.W., C.W. and R/T transmissions between 200 and 800 Kc/s.

In the demonstration Tri-Pacer the ferrite-core loop aerial was mounted beneath the fuselage and the receiver/control box above the windscreen in front of the right-hand pilot's position, with the 2¼in dial indicator fitted among the standard panel instruments. The total weight of the system is 10½ lb and its power consumption is 33 watts. The indicator can be of 3¼in or 2¼in diameter and is marked in graduations of 2 deg.

The power unit operates direct from the 28 V aircraft supply and uses a transistor oscillator. The receiver, housed in the control box, consists of four sub-units: (1) R.F. amplifier, with sub-miniature valves, (2) I.F. amplifier with detector, local oscillator and A.G.C. circuits (transistors and sub-miniature valves) (3) servo amplifier, transistorized, and (4) transistorized A.F. amplifier.

Since the first demonstration of the French equipment in this country in August 1957, a number of detail improvements have been effected in the construction and mounting of the compass, and Elliott Brothers are now about to begin production at a selling price of approximately £850.

Also displayed at Southend on this occasion, which coincided with the conference of the Guild of Air Traffic Control Officers (see page 691), was a range of radio, radar and navigation equipment now being manufactured by Elliotts. This included the "21 series" of VHF equipment and the E-RDR-1D weather/anti-collision and terrain-mapping radar built under licence from the Radio Division of Bendix Aviation Corporation.

CONSTANT-SPEED DRIVES

AS briefly noted in these pages last week, orders to the value of over £4m are likely to be placed with British and U.S. manufacturers of constant-speed drives for the A.C. electrical systems of 400-odd airliners now on order and due for delivery beginning next year.

This was stated by Mr. H. M. Sutcliffe, of the technical sales department of English Electric's aircraft equipment division, in a lecture before the Yorkshire Branch of the Graduate Section of the Institution of Mechanical Engineers. Extensive service facilities would be needed for the overhaul of the drives, continued Mr. Sutcliffe, for some 12,000,000 flying hours would be logged by these aircraft over the next ten years. "Further orders anticipated will increase this figure considerably," he added.

Although a large number of military aircraft (including the Vulcan B Mk 2, B-47, B-52 and KC-135) were already flying with c.s. drives, the era of the constant-speed A.C. electrical system on civil aircraft was only just beginning. The introduction of these systems had come about because of the greater electrical demands caused by the increased number of radar, radio and navigational devices, the use of electrical power for de-icing and the general increase in electrically operated devices in remote parts of aircraft. The A.C. systems had been adopted to increase the power output and voltage level of generation equipment of given size, and to eliminate commutation troubles at high altitudes. Electrical power requirements on aircraft had grown in 15 years from the 8 kW D.C. system of the Lancaster to the 120 kVA constant-frequency A.C. system on the latest types.

The c.s. drive in most extensive use today was the hydro-mechanical type developed by Sundstrand Aviation in the U.S.A. and produced under licence by English Electric. A typical drive of this type, mounted on a turbine engine, accepted input speeds between 3,000 r.p.m. and 8,000 r.p.m. and provided a 50 h.p. drive at 6,000 r.p.m. to a 40 kVA, 0.8 p.f. alternator. This drive was a differential device in which only the power represented by the difference between the input and output speeds was transmitted by the hydraulic fluid, and either added to, or subtracted from, the input speed to maintain the output at 6,000 r.p.m.

Mr. Sutcliffe discussed three other forms of c.s. drive—air turbine, friction and slip—and, looking into the future, said that he thought some "electrical black box" method would ultimately replace the mechanical, hydraulic or pneumatic ways of providing constant frequency A.C. electrical power on aircraft. He mentioned two possibilities: an alternator with transistor-controlled variable-excitation frequency, and a field-modulated constant-frequency alternator. In the first device a generator on the alternator shaft would provide a signal to a discriminator circuit which supplied a frequency-difference signal to a control unit providing excitation power to the alternator rotor at the different frequency. This would enable the magnetic field of the rotor and stator to rotate at a constant 400 c.p.s. The second suggestion envisaged 400 c.p.s. modulation of the excitation of a variable high-frequency alternator, using static equipment to demodulate the output and invert alternate pulses of the varying D.C. output to form constant frequency A.C. power.

LOX IN SERVICE (continued from previous page)

and liquid phases are prevented by relief valves (6 and 7).

The converter is recharged through the filler valve (8) which is combined with the "vent and build-up valve" (9). This latter vents the converter to atmosphere automatically when the charging coupling is connected, so that it is impossible to fill the converter while it is pressurized. The level of lox in the converter is measured by a capacitance probe, the measurement being converted by the gauging unit (11) to give a contents reading on gauge (12) in the cockpit.

B.O.A.E. are now preparing for the production of their lox breathing systems to equip the latest generation of Service aircraft. A Canberra is being modified for flight tests of the latest components and a recent visit to the company's works at Harlow New Town, Essex, revealed a surprising amount of research apparatus in operation, including temperature and altitude chambers, vibration rigs and even a small centrifuge capable of subjecting 100 lb of equipment to 20g accelerations.

Work is not confined to lox breathing systems. B.O.A.E. have perfected a very efficient liquid-nitrogen explosion-suppression system for fuel tanks and have in production a range of liquid oxygen and kerosine valves, gauges and diluter demand oxygen regulators. Of these, the A.12 regulator is fitted to the Britannia, Friendship, Dart Herald and A.W.650 Argosy. Being basically of Aro design, it has the sales and servicing advantages of being similar to American regulators used on the DC-7 and other types.

The Company's U.S. associations, and licensed production of U.S. equipment, have been valuable in obtaining spares contracts for aircraft flown by NATO air forces in Europe, in addition to which a large contract for A.14 pressure-breathing diluter demand regulators was received recently from Switzerland.

The British side of the partnership is no less helpful, because the British Oxygen group is able to supply all the support equipment needed by the R.A.F. and Fleet Air Arm. The lox itself has been in production by the parent company for many years, and its supply presents no problems wherever aircraft fitted with lox breathing may be operated. Bulk storage tanks, aerodrome storage and handling equipment are already available from British Oxygen Engineering, Ltd.; and a unique example of group interdependence was evident at Harlow, where a Beaver 2 respirator (an artificial breathing aid) produced by the British Oxygen Medical Equipment Division is being used to simulate a human pilot in certain altitude-chamber tests.

Getting Together on Separation

AIR TRAFFIC CONTROL OFFICERS RAISE TOPICAL POINTS AT CONVENTION

THE Guild of Air Traffic Control Officers must have been most gratified by the success of their convention, held on Thursday and Friday of last week. Apart from a large attendance of members, there were representatives of the Services and Ministries, including the Controller of Ground Services at the M.T.C.A.; of the Corporations and other airlines; of the American Civil Aeronautics Administration; of the International Federation of Airline Pilots' Associations; and of the industry. There were also several Continental visitors. The Mayor of Southend, where the convention was held, gave enthusiastic support.

There were five questions in particular that caused much discussion:—

(1) How can separation be achieved among cruising jet aircraft in view of their requirement for climb-cruise?
(2) How can the recurring problem of different military and civil control requirements be satisfied?
(3) What navigational aids will be chosen for international use next February?
(4) Will automation and the introduction of computers really make the controller's life easier?
(5) What is the best long-range radar band?

Numerous other problems were discussed, but these five questions came up repeatedly, and a number of answers were given—a summary of them is given at the end of this report.

The Opening Assembly. In welcoming the delegates the Mayor referred to the mid-air collision over Nettuno which had taken place the previous day, and how it served to throw tragic emphasis on the importance of air-traffic control. At Southend, with its increasingly busy airport, they were very conscious that there was no longer "plenty of room in the air."

In reply, the Master of the Guild, Mr. W. C. Woodruff, spoke of the developments which had taken place since their first convention had been held two years previously. The Guild now enjoyed a happier relationship with the M.T.C.A., and although the jam for tomorrow's bread-and-butter was not yet in sight, at least a recipe was being prepared; the ingredients included such items as new radar and computers.

In speaking of these developments Mr. Woodruff gave one answer to the first of the questions listed above. It was wrong, he suggested, for constructors to build aircraft without any thought as to whether they would fit in with a practical system of control. It would be impossible, he emphasized, for every jet airliner in a congested airspace to be given its optimum cruising conditions. Before a machine was built, consideration should be given to its ability to offer various rates of climb and descent and intermediate approach speeds, and in particular to operate at various flight levels.

The next speaker was a representative of the United States Civil Aeronautics Administration, Mr. W. T. Deason. In a paper on *Practical Problems and Future Development of Air Traffic Control* he emphasized the tremendous increase in traffic handled by American controllers in the last ten years. In some aspects this increase has been six-fold, and in some as much as ten-fold, and at increasingly high speeds. The New York Centre might at times handle—and this was all manual work—as many as 1,500 flight progress slips an hour.

To cope with these and coming developments, many improvements were at some stage of realization. New radar covered high-density routes; on the three main transcontinental routes traffic was fully controlled above 24,000ft and soon this would be 15,000ft; more use was being planned of computers, closed-circuit TV and recorders, and new aids to navigational separation were coming along.

One choice of these aids would seem to be VORTAC, and as an illustration of the value of its D.M.E. aspect, Mr. Deason showed a 35-minute film. This made the obvious points on D.M.E. helping descent clearances, reducing the size of holding areas, and enabling a greater traffic frequency on an airway. It also made a feature of orbital avoidance. Mr. Deason had said he was "not trying to sell D.M.E.," and he took in good part the remark of a delegate who pointed out that British airliners had been using it for at least 13 years. [British official preference is, of course, for the Decca system.]

Jet Problems. The other paper on the first day had been prepared by Mr. E. Smith, B.O.A.C.'s navigation superintendent (eastern routes). In discussing *Some Aspects of Jet Operations*, he made the telling point that for the planners it was now nearly ten years since the jet age had started. One thing dominated jet operations—fuel consumption. On a weight-to-weight basis this was about three times greater in a jet than in a piston aircraft. Mr. Smith gave some interesting figures showing the proportion of fuel as compared to gross weight for various aircraft: Long-range piston aircraft, e.g., DC-7C, 32 per cent; long-range turbo-prop, e.g., Britannia 312, 37½ per cent; Comet 4, 45½ per cent; Boeing 707-120, 46 per cent; DC-8 (domestic J57), 50 per cent.

On an Atlantic crossing the 707 was likely to consume about 100,000 lb of fuel. Thus the amount carried for various reserves must be limited if an effective payload was to be carried. As far as operators were concerned, therefore, it was vitally important that both the Comet 4 and the Boeing 707 were able to fly the cruise-climb procedure. If the Boeing was restricted to 2,000ft steps, and even if each successive clearance upwards was prompt, it would sacrifice 750 lb; or in the case of 4,000ft steps, 13,000 lb. Another handicap might be terminal weather, for the fence speed of 135 kt might mean higher minima.

The paper disclosed some of the problems overcome during the Comet evaluation trials on the North Atlantic. At times H.F. communication broke down, while the lack of telephone link between various controllers during daylight hours had aggravated matters. (It was comforting to hear, during the ensuing discussion, that these matters are being actively tackled.)

B.O.A.C. had been carrying out extensive trials of Dectra/Decca on this North Atlantic crossing, and there seemed little doubt that this could meet the long-range aid requirement. They had also been doing early evaluation trials on Doppler on one eastern-route Britannia, and were optimistic about this aid.

The main conclusions of Mr. Smith's paper were that on the Atlantic the civil jet operations were at the mercy of the military; that vertical-separation systems must go; and that, to achieve this end, navigational accuracy must be increased in order to obtain lateral separation and perhaps traffic flow separation.

Trends in Air Traffic Control. This was the title of the paper given by Captain V. Hunt, Director of Control and Navigation at M.T.C.A. He began by stating that there was still some scope for visual collision-avoidance, but that the present "rules of the air" would benefit by modification, in particular by a nullification of the concept of "right of way." He explained the Ministry's proposals, and thought that such new rules should be extended to radar-control collision-avoidance.

The Ministry, he continued, was preparing a plan for licensing A.T.C.O.s, and the scheme envisaged a rating system.

Capt. Hunt went on to discuss the question of jets on the Atlantic. He thought they would seriously interfere with one another, and he envisaged a route system as a solution, which would require an accurate long-range aid—which might perhaps be Dectra. Even today, he showed, aircraft frequently passed over each other with only the minimum A.T.C. separation. During the next few years the difference in speeds of jets and other aircraft would bring many problems, particularly as regards positioning near airfields. Detailing the Ministry's plans for the future, he thought that the policy of making better use of existing airspace was better than that of demanding more space from that assigned to the Services. He also made the telling point of the need to maintain a balance as improvements to the A.T.C. system were made; otherwise a new radar chain, for example, could swamp the service with information. Just the same, the Ministry would avoid delays in introducing new equipment when it did become available.

Traffic-control Displays. A paper on this subject, read by Mr. D. D. Lipman, Head of the M.T.C.A. A.T.C. Experimental Unit, was more technically specialized than the rest, and to more than one member of the audience was surprising to hear someone from an experimental unit laying such repeated emphasis on the practical aspects of the job. Far from being concerned with automation at all costs, the speaker was also interested in personal limitations, and the fact that the efficiency of display was limited by the overall efficiency of the system.

He considered that, as distinct from dynamic (aircraft) information, there was an excess of static information relating to navigational warnings, etc., which resulted in the A.T.C.O.'s desk "looking like an advertisement hoarding." This excess should be reduced, not for the sake of aesthetics, but for efficiency, and even the number of position reports might be reduced. The emphasis must be on *vital* data.

Mr. Lipman enlarged on the difficulties associated with automation and automatic data-processing, and the way in which information must be pre-digested before being fed into computers; and he called for brighter pictures on radar consoles in order to help solve the conflicting requirements for illumination at the A.T.C.O.'s desk.

The Human Element. This final paper of the Convention had been prepared by the Guild and was read by Mr. L. Vass, the Assistant Clerk of the Guild. It made some light-hearted but astringent criticisms on the equipment manufacturers, who (it was alleged) were all too ready to produce devices without first finding out whether or not they were what the A.T.C.O.s wanted. Far too often, in the view of the Guild, equipment was designed from

GETTING TOGETHER ON SEPARATION . . .

the start on false premises, although the situation was improving. But even if equipment were ideal, it was on the human element that the entire A.T.C. system depended.

Like the previous paper, this one called for brighter radar presentation, and it claimed that "a commonplace P.P.I. tube in every tower and centre," capable of daylight presentation, would give greater air safety than a dark room full of "wonder-boxes." It also spoke against the abandoning of 3 cm and 10 cm radar, because although these wavelengths were subject to intereference by weather, they also gave the controller a better chance of guiding aircraft round turbulent cloud. A suggestion was also made for using radio-linking in order to make duplicate presentations from one radar aerial installation, and it was claimed that this would be a very economic proposition, besides helping to solve the difficult problem of civil and Service liaison. Mr. Vass described how some analogy had been drawn between A.T.C. and railway signalling, but emphasized that the addition of the extra dimension, coupled with the fact that aircraft could not be stopped in flight, made this comparison specious. He called, like previous speakers, for improvement in the navigational aids on the Atlantic, so that one aircraft need no longer be separated from another at the same height by 120 miles laterally and 30 minutes' flying time longitudinally; and called again for improved communications, and for a reduction in navigation warnings of dubious value.

He ended by making an extremely convincing appeal for A.T.C.O.s to be given better facilities by the operators to fly as supernumerary crew members. It is quite certain, he said, that such experience was invaluable in increasing air safety.

Any Questions? Following a banquet luncheon, the second afternoon was devoted to a discussion in the form of "Any Questions?" under the chairmanship of A. Cdre. Wheeler. The panel consisted of: Dr. Payne, Messrs. Morgan, King, Settelen, Harris and Coopman; an I.F.A.L.P.A. representative, Mr. Lane; and three Guild Members: Lt-Cdr. Mogg and Messrs. Field and Vass.

As fatigue was the enemy of personal efficiency [a question was asked], would the panel agree that poor working conditions were the Achilles' heel in the A.T.C. system? Did the panel realize that on some days there were as many as 600 aircraft movements across the Channel below airways height? Some of the questioners asked for reassurances—as for instance, when the industry stated positively that there was no radiation risk from P.P.I. consoles. (Someone remarked that watching television "could kill you, but not through radiation.") There was discussion of the various radar specifications and wavebands, the low rate of climb of heavy aircraft, and, of course, of the five main questions listed at the start of this report.

Conclusion. To a non-member of the Guild this convention seemed more mature than the one held in 1956. It was also a more representative gathering, as was made clear when some of the guests rose at the conclusion to thank the Guild for its hospitality. No clear-cut answers were given to the five questions of the day, but the general feeling seemed to indicate that:—

(1) Far more use must be made of lateral separation of aircraft, and navigational facilities must be improved to this end.

(2) The joint committee which allocates airspace in the U.K. must continue to do so as efficiently as possible, and although A.T.C. is the servant of the public, not its master, efforts should be made to restrict the number of unimportant events such as air displays which interrupt the rhythm of A.T.C. work.

(3) It seems likely that just as V.O.R. is being used increasingly, so will D.M.E. Nevertheless, efforts should be made to promote and perfect Dectra and Decca.

(4) The application of automation to A.T.C. must be made most carefully, otherwise it may only result in the wrong answers being produced more quickly.

(5) Whatever long-range radar is installed, it should still retain adequate storm-warning facility.

THE ARROW'S FUTURE

THE future of the Avro Arrow was the principal subject of an address given by Mr. Crawford Gordon (president of A. V. Roe Canada) at the company's annual general meeting in Toronto last Monday. Avro Canada, he told shareholders, "are confident that the Arrow and the Iroquois engine will be ordered into production when Canada's Air Defence Programme is reviewed in March."

There were three main reasons for this confidence. The first was that: "for the foreseeable future, the manned intercepter will continue to be an essential part of the North American defence system. Pilotless intercepters, such as the Bomarc, complement it but cannot effectively replace it."

The second reason was the fact that "the Arrow was specifically designed to fit the R.C.A.F. requirement for a manned intercepter in the time period involved—and we believe that it still best fits that requirement."

The third was that a decision to produce the Arrow with its Iroquois engine for squadron service with the R.C.A.F. would involve an actual cost from this point on of about one-third the amount most people seemed to expect—$3,500,000 per aircraft against $9,000,000 per aircraft on the basis of 100 being ordered. The figure previously mentioned for 100 aircraft ($9,000,000 each) included the whole basic development and tooling costs. These expenditures, he said, should be eliminated from a realistic appraisal of the possibility of continuing the programme because they have "already substantially been incurred or committed" and could not be recovered whether the programme was continued or not.

By considering only those costs which would be incurred in the actual production of Arrows for combat use and including the new savings, it was estimated that "we can produce 100 Arrows, complete in every respect, including the cost of the engines and fire control system, and excluding only the missile armament, for a cost of approximately $3,500,000 each."

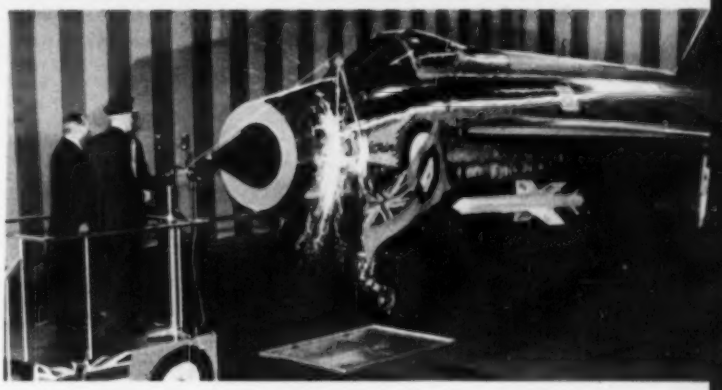
In the chairman's report given at the meeting, Sir Roy Dobson spoke of the many new interests of the Hawker Siddeley Group in Canada, saying that employment figures—now 41,000—had nearly doubled in the past year. Net profit, at $8,283,701, was up by 15.4 per cent. In referring to the Group's aeronautical activities, Sir Roy said: "We are convinced that in all future aircraft there will be some element of vertical take-off. Your companies have not been lagging in this and other new branches of aeronautical science."

NORWAY ADOPTS BRITISH EJECTION SEATS

FOLLOWING a number of unsuccessful ejections from American aircraft, particularly at low level, the Royal Norwegian Air Force has decided to replace American ejection seats with those of Martin-Baker design. Accordingly, during August and September, an F-86K, an F-86F and an RF-84F were flown by Norwegian pilots to the Martin-Baker airfield at Chalgrove, Bucks. The existing ejection seats were removed and replaced by Martin-Baker Mk 5 series seats. Installation was found to be extremely simple, no structural alterations were necessary and all pick-ups for seat and leg-line brackets and other fittings were made to existing aircraft strong-points. The work was completed in only eight weeks and the aircraft have now returned to their airfields in Norway.

The Mk 5 series is the one fitted in certain U.S. Navy aircraft; it is fully automatic and can be used at ground level. Mk R.5, S.5 and T.5 seats were fitted respectively in the F-86F, F-86K and RF-84F. It now seems likely that other NATO countries will follow the Norwegians' example.

Left, The RF-84F Thunderflash (Capt. Hengebol) and the F-86K shortly before take-off on their return to Norway. Right, Capt. R. B. Norberg, Royal Norwegian Air Force, in the Martin-Baker Mk 5.5 seat of his F-86K



Marshal of the Royal Air Force Sir Dermot Boyle, the C.A.S., in company with Sir George Nelson, chairman of the English Electric Company, surveys the well and truly broken champagne bottle and the brand-new name on the first Lightning. Below, the scene seconds earlier

"Flight" photographs

Champagne for the Mach 2 Fighter

THE LIGHTNING OFFICIALLY NAMED

AT R.A.E. Farnborough last week the English Electric Lightning (two Rolls-Royce Avon) was officially and formally named in traditional style. As the first machine of the type, XA 847, stood in a hangar, its freshly painted name covered by the R.A.F. Ensign, a bottle of champagne poised on a special smashing-rig beside the nose was released against the side by the Chief of the Air Staff. Senior officers of all three Services, and representatives of the three companies most concerned with the weapon system, heard Sir George Nelson, chairman of the English Electric Company, pay tribute to all those who had had a part in development of the Lightning. He said he was honoured that the R.A.F. should have entrusted the design and development of so important a machine to his company. The Lightning would be complementary to the V-bombers in providing the means of preventing war.

Sir George recalled that his company had since the 1930s produced some 5,000 aircraft, including 770 Hampdens, 2,250 Halifaxes, 1,400 Vampires and over 500 of English Electric's own highly successful Canberras. More than 1,400 of these had been produced altogether, including 400 under licence in the U.S.A.

The Lightning project began in the early 1950s, backed by design facilities which included the first privately owned supersonic wind tunnel in this country. The two P.1A research models had completed four years' flying after the first flight on April 4, 1957. This was made by R. P. Beamont, who had been in charge of flight development ever since. The overall responsibility for the design and development of the Lightning has rested with Mr. F. W. Page, the chief engineer of the company's Aircraft Division.

Performance of the Lightning is still secret, but it has been stated that it has flown at speeds of 1,200 m.p.h. Sir George Nelson noted that, with this speed capability, the machine could fly from Farnborough to Paris in some 15 min. Its armament consists of two de Havilland Propellers Firestreak infra-red homing air-to-air missiles which could be exchanged for unguided air-to-air rockets or two 30mm Aden guns. A pair of Aden guns is also carried in fixed mountings beside the cockpit. Automatic weapon delivery is controlled by the Ferranti Airpass radar system coupled with an autopilot.

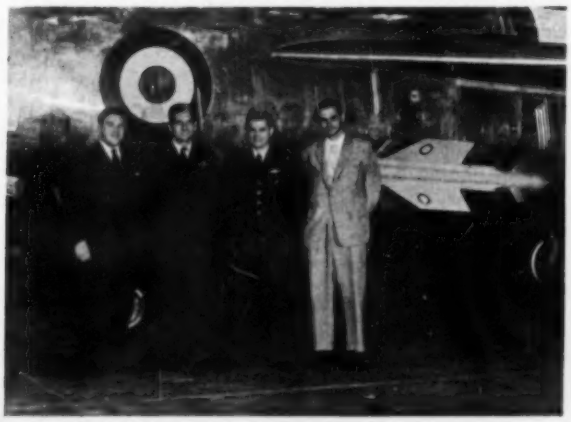
English Electric state that they can foresee Lightning development and operation for the next ten years. Already the type has proved itself to be equal to or better than anything available elsewhere in the free world and more than 30 pilots have so far flown it. Recently Lt-Col. C. E. Anderson, Chief of Flight Test Operations Division at Edwards A.F.B., and Capt. D. K. Slayton of that division, flew the Lightning at Warton and were warmly enthusiastic about its high acceleration and rate of climb and its inherent stability at all speeds without autostabilization. Further development of the Lightning includes the fitting of larger and more powerful air-to-air guided weapons, for whose equipment room is already available within the present airframe.

Performing the naming ceremony, Sir Dermot Boyle, the Chief of the Air Staff, said he was delighted that the aircraft now had a name to replace the numerous code-names and symbols by which it had hitherto been known. He paid tribute to Rolls-Royce, Ferranti and de Havilland Propellers for their part in the design. The Lightning would, he said, achieve a genuine Mach 2 with full war load and carry an accurate, effective and reliable missile. In conjunction with the highly efficient British control and warning organization it would provide an effective British contribution to Western defence and form a fitting complement to the V-bombers which had recently acquitted themselves so well in competition with Strategic Air Command in the U.S.A. As he pulled the cord which released the champagne bottle with a loud pop against the fuselage, and the ensign fell away from the newly painted name, the R.A.F. Central Band struck up the R.A.F. march-past outside the hangar.

Shortly afterwards "Bea" took the machine up for a demonstration of a calibre which has come to be associated with his name. Under a low cloud base and in poor visibility he pulled the Lightning into a series of almost unbelievably tight turns and steep climbs. He finally landed with a ground run of little more than 1,000 yd, taxying in on one engine. He tells us that it is customary to cut No. 1 Avon immediately after touchdown. Both engines at idling power will propel the Lightning along tarmac at a spanking 80 m.p.h.

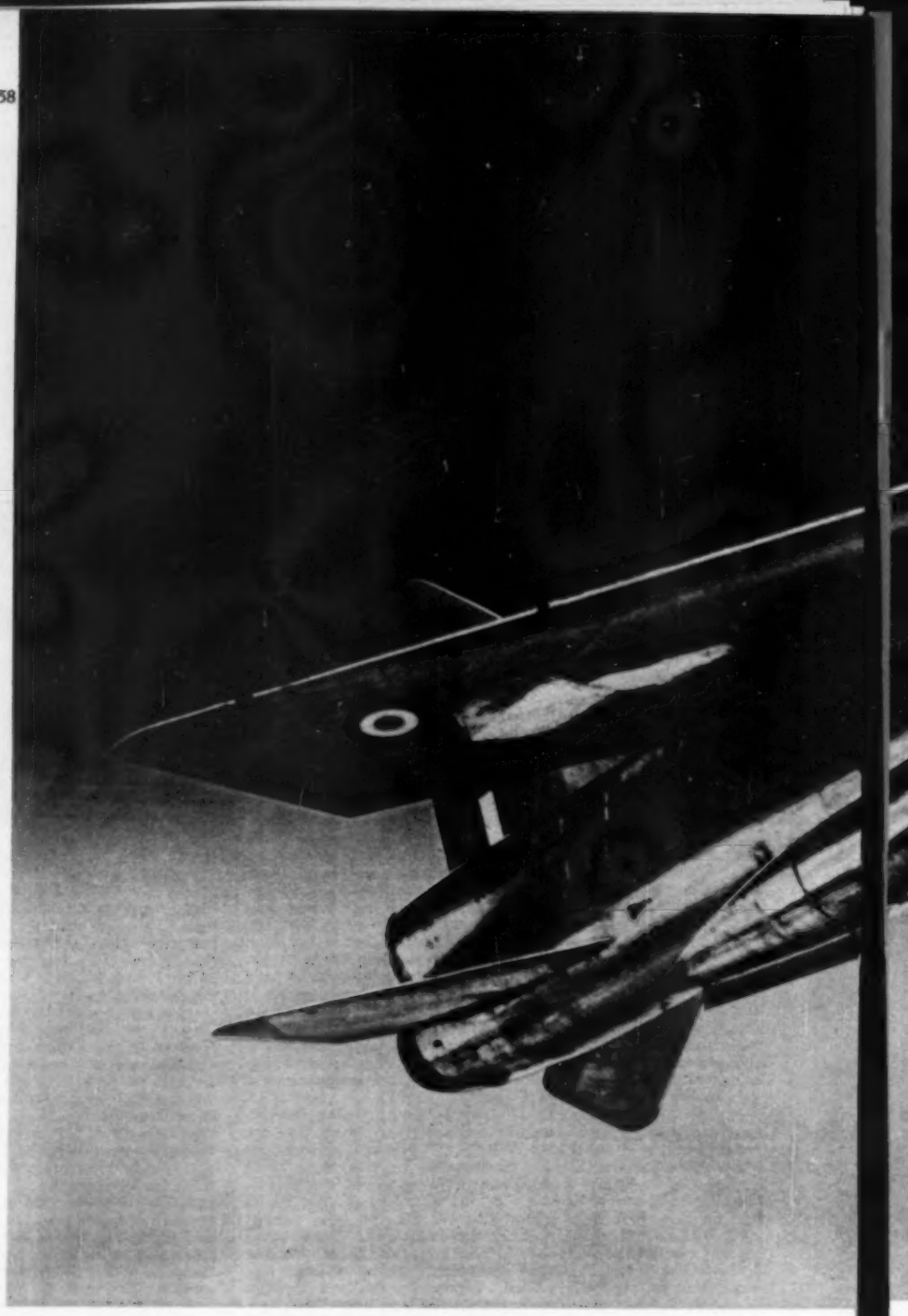
[*Pictorial feature overleaf*

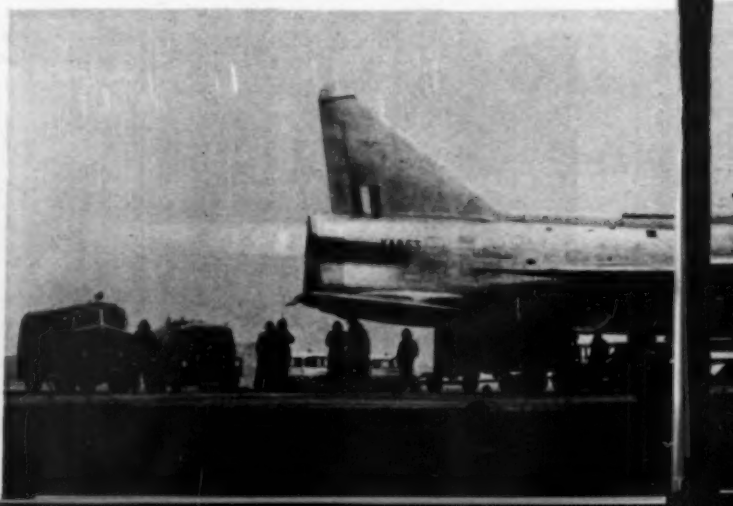
R. P. Beamont prepares for a sizzling demonstration of tight turns after the naming ceremony at Farnborough. At right he is seen with Lt-Col. Anderson, Capt. Slayton and Mr. K. Lush of Edwards A.F.B. after the two U.S.A.F. pilots had themselves flown the Lightning at Warton

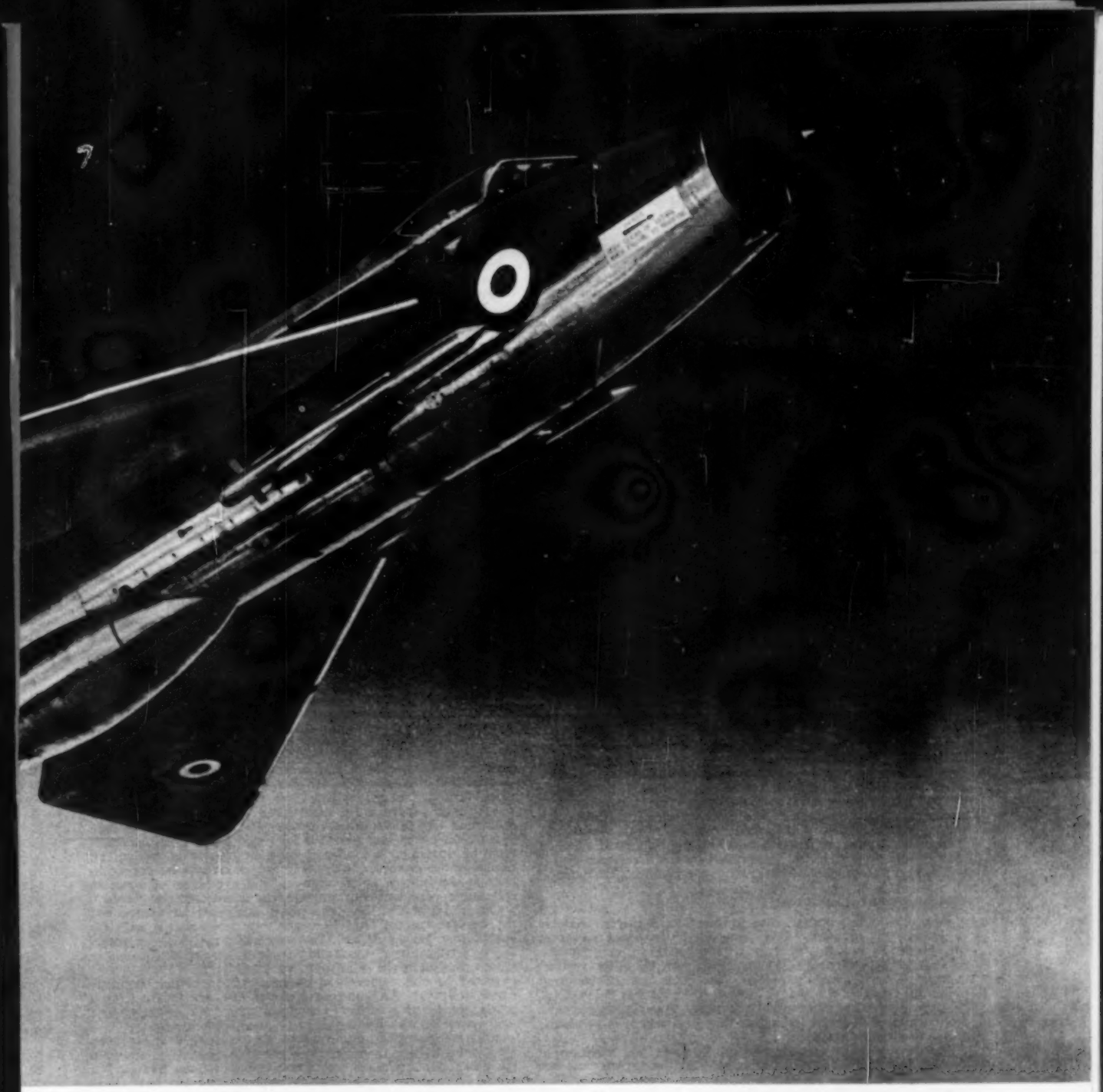


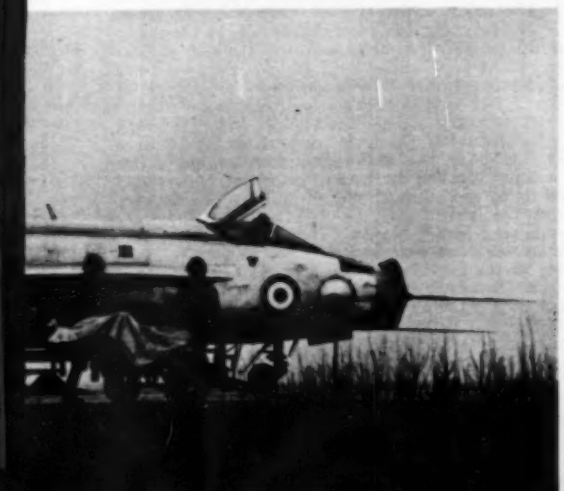
ENGLISH ELECTRIC LIGHTNING

—the R.A.F.'s future all-weather intercepter fighter, is seen in a recent "Flight" copyright photograph (right) by L. W. McLaren. The aircraft was officially named on Thursday of last week by the Chief of the Air Staff, as described on the preceding page. The turbojets are Rolls-Royce Avons with reheat. Primary armament consists of two de Havilland Propellers' Firestreak infra-red homing missiles; two 30 mm Aden guns comprise the secondary armament. Below, Lightnings are seen at the makers' Warton (Lancs) airfield









Nothing New Under the Moon?

A "PIONEER" PROPHECY OF 1865

By R. RANDAL PHILLIPS, Hon. A.R.I.B.A.

EVERYBODY knows that Jules Verne wrote a tale about a trip to the Moon. "*De la Terre à la Lune*" was published in 1865. The present generation will never have read the book (which is not readily available), and few of the older generation will remember anything about it. Seeing that it has many parallels with the recent American attempts, it is worth while recalling some of the details.

It all started with a special meeting of the Gun Club of Baltimore, which was a circle of artillerymen formed after the American Civil War. The president, Impey Barbicane, put forward the astounding proposal that they should send a shot to the Moon. He said he had made calculations and that a projectile with an initial velocity of 12,000 yd per second would reach the Moon. The committee decided that it was first necessary to consult the Observatory of Cambridge, in Massachusetts, which was celebrated for its astronomical staff. They said Yes, it was possible to send a projectile to the Moon, provided it had an initial velocity of 12,000 yd per second. (This is equivalent to 24,500 m.p.h., compared with 24,000 m.p.h. given as the initial speed of the American Moon rocket Pioneer.) The observatory staff added: "The Moon does not describe a circle round the Earth, but rather an ellipse. Therefore, at certain times it approaches nearer to, and at other times it recedes farther from, the Earth: in astronomical language it is at one time in perigee, at another in apogee. In its perigee the Moon is 218,657 miles distant, and in its apogee 247, 652 miles." (These figures compare with 223,700 miles as the distance given earlier this month in connection with Pioneer.)

Two other questions were put by the committee. How long would it take the projectile to reach the Moon, and from where precisely should it be discharged? The answers were: "If the shot should preserve continuously its initial velocity of 12,000 yd per second it should require little more than nine hours to reach its destination. But inasmuch as that initial velocity will be continually decreasing it will occupy 83 hours 20 minutes in reaching the point where the attraction of the Earth and the Moon are in equilibrium. From this point it will fall to the Moon in 13 hours 13 minutes 20 seconds. It will be necessary to choose the period when the Moon will be in perigee and also the moment when she will be crossing the zenith. By a fortunate circumstance on the 4th of December in the ensuing year the Moon will present these two conditions. The point on the Earth from which the projectile should be discharged must be within the degrees 0 deg and 28 deg of latitude. The shot should be discharged at 10 hours 46 minutes 40 seconds on the 1st December and it will meet the Moon precisely at midnight on the 4th of December."

Cannon near Canaveral

Armed with this authoritative information, Barbicane and his committee set to work. They concluded they must construct an enormous cannon, far bigger than anything in existence. Barbicane decided to do so by casting it vertically in the ground, pointing directly up to the Moon. The choice of a site narrowed down to Texas or Florida. Ultimately Florida was decided on. (Here is another curious parallel with today, since Cape Canaveral, from which the American rockets are discharged, is at almost the same spot in Florida.)

Before work was actually started, however, the question of finance had to be settled. Barbicane said the project was not merely of American but universal interest. Subscriptions were therefore invited. They came in from Paris, St. Petersburg, Berlin, Stockholm and other capitals. After three days 4,000,000 dollars had been subscribed. Russia gave 368,733 roubles. "No one need be surprised at this," said Barbicane, "bearing in mind the scientific taste of the Russians, and the impetus they have given to astronomical studies." France began by deriding the pretensions of the Americans, but eventually subscribed 253,930 francs. Switzerland contributed 257 francs. Spain could not scrape together more than 110 reals. Great Britain did not subscribe a farthing—"They hinted that the enterprise of the Gun Club was contrary to the principle of non-intervention." With the contributions from the Americans, the grand total reached 5,446,675 dollars—roughly a million pounds sterling. (The Moon rocket Thor Able 1, fired by the Americans on the 17th August last—and which blew up 77 sec after launching—was estimated to have cost three million dollars.)

At the site in Florida, with an imported army of workmen, a start was made on the 4th of November by digging a hole in the earth 60ft in diameter and 900ft deep (which is six times the height of the Nelson Column in Trafalgar Square). A wheel of oak of immense strength was employed. Around this a wall of masonry was constructed. The wheel was then undercut in sections, leaving supporting blocks at intervals of 2ft, and as these were subsequently removed the wheel sunk by degrees, and with it the ring of masonry. By the 10th of June the hole had reached a depth of 900ft. At the bottom a massive block of concrete 30ft thick was constructed. Then, within the space excavated, a central column 9ft in diameter was formed with a mixture of clay and sand mixed with a little hay and straw. This was maintained in position by being bound with iron bands and fixed at intervals with clamps fastened into the stone lining.

While this work was going on 1,200 reverberatory ovens were set up around the hole, and charged with iron bars and coal. At a given signal, by the firing of a gun, on the 9th of July, all the furnaces were opened simultaneously and the molten metal flowed into the hole, between the core and the enclosing wall. As the casting proceeded the ground trembled and dense clouds of steam went up high into the air. More than a month elapsed, actually till the 22nd of August, before the metal had all cooled and the earth could be walked upon. Work then started on excavating the interior mould, preparatory to boring the cannon. This was done with powerful machines, and by the 22nd of September, less than a year after the scheme was projected by Barbicane, the enormous weapon was finished. The enclosure was then thrown open to the public, who arrived from all parts of the globe. To gratify their curiosity, men, women and children were let down by a steam crane, at a fixed price of five dollars per head. This put nearly 500,000 dollars into the pockets of the Gun Club. Needless to say, privileged members were the first to make the descent. A table was laid at the bottom, and a splendid repast was enjoyed 900ft below the surface of the Earth.

Projectile off Course

Two months remained before the discharge of the projectile to the Moon. At this juncture a telegram arrived from Paris, via Valentia and Newfoundland. It was signed "Michel Ardan" and read "Substitute for your spherical shell a cylindro-conical projectile. I shall go inside." Originally it had been intended to make the projectile of cast iron, but Barbicane's calculations showed that this would be too heavy. It was therefore cast in aluminium, 12ft in height and 9ft in diameter. The upper part was thickly padded with leather and springs and there were scuttles of very thick glass at the sides and at the top and bottom. A reservoir of gas was provided for warmth and light. Replacement of vitiated air was effected by a preparation of potash. To discharge the projectile, 400,000 lb of guncotton were packed in bags at the bottom of the cannon, and a cushion of water in collapsible partitions was provided to counteract the recoil.

On the 1st of December everything was ready. Barbicane and the secretary of the Gun Club got into the projectile with the Frenchman, Michel Ardan. There were also two dogs—a spaniel and a Newfoundland—and some chickens. At about a quarter to eleven that night the guncotton was fired by an electric battery operated by the engineer in charge. An appalling, unearthly report followed. An immense spout of fire shot out as from a crater; there was a perfect earthquake; and the huge crowd that had assembled to witness the event were thrown down.

What happened to the travellers? At the moment of explosion they were all lying down on their prepared couches in profound darkness. Some minutes later Ardan moved to raise himself, but felt like a drunken man. After a short time he recovered. He lit the gas burner and looked around him. Everything seemed to be pretty well as it was. His two companions, however, remained prostrate. He started rubbing them, and bit by bit they came back to consciousness. Then Barbicane asked excitedly: "Are we moving?" The others could not tell. Barbicane, however, sensed that the temperature inside the projectile was singularly high. He took a thermometer from its case and examined it. The instrument showed 81 deg Fahr. "Yes," he exclaimed, "we are moving. This stifling heat has been produced by the friction of the atmosphere. It will soon diminish, because we are already floating in space, and after having been nearly stifled we shall have to suffer intense cold. Listen, Michel. It is five minutes to eleven. We have been gone about eight minutes, and if our initial speed was not checked by the friction, six seconds would be enough for us to pass through the 40 miles of atmosphere which surrounds the Earth."

They got up to see where they were. The metal plates covering the glass scuttles were removed, and they peered outside. Profound darkness surrounded them, with stars like bright points in the black sky. Suddenly Barbicane's attention was attracted by the approach of a brilliant object, an enormous disc advancing

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Nothing New Under the Moon? . . .

at great speed. A collision seemed inevitable. But the object passed them several hundred yards away and disappeared. "What is it?" asked Michel. "It is," said Barbicane, "a meteorite which the attraction of the Earth has retained as a satellite."

A quietude settled upon them, and presently all three lay down to sleep. They were awakened by the barking of a dog. It was the spaniel. She was found under the couch, where she had lain, terrified and shaken by the initial shock, until hunger forced her voice. But where was the other dog, the Newfoundland? They searched, and at last found him at the top of the projectile, where he had been hurled by the explosion. His skull had been broken by the roof, and he was dead. A scuttle was opened and he was launched into space. Shortly afterwards Michel, looking through a scuttle saw what seemed to be a flattened sack some yards from the projectile. Barbicane explained that it was the dog, travelling with them through space.

On December 4th, at 5 a.m., all three travellers were up. It was to be the last day of the journey, if calculations were correct. That very night, at 12 o'clock, exactly at the full Moon, they would reach its brilliant disc. But Barbicane was uneasy. He made certain observations. These showed that the projectile's course had been slightly deflected. How? Suddenly he realized that the deviation must have been caused by the meteorite that had crossed their path. Consequently they would never reach the Moon. They gazed at it as it got nearer and nearer. At 6 o'clock the lunar pole appeared in brilliant light. Then suddenly the line of demarcation between intense light and absolute darkness was passed, and they were plunged into profound night. And it was getting intensely cold. They lit the gas and saw that the thermometer had fallen to 17 deg C below zero (equal to 1 deg F). A thick coat of ice covered the scuttles. Barbicane solemnly considered the matter, then said: "My friends, by an unalterable influence our position in relation to the Moon has been changed. Our base is now turned to Earth. At the point of equal attraction our speed will be nil and we shall fall, not on to the Moon, but to Earth, at a speed equal to our initial discharge!"

* * *

Up to this point Jules Verne's tale seems convincing enough, but the end is not credible. It recounts that an American corvette, taking soundings in the Pacific Ocean, heard a hissing sound in the sky and shortly afterwards saw an object floating like a buoy in the sea. A boat was lowered and, as it approached the object, the American flag was seen flying from the top. One of the scuttles was open and as the boat came alongside the officer in charge heard: "White all, Barbicane, white all." He looked inside, and there he saw the three travellers playing dominoes!

Fiction (1865) and Fact (1958) Compared

	Jules Verne's projectile, 1865	American Moon rocket, August 17, 1958
Firing site	Florida	Florida
Distance from earth to moon ...	218,657 miles	226,000 miles
Dimensions of projectile	cannon, 900ft projectile 12ft x 9ft	88ft: cap with instruments, 2ft 6in
Estimated time of travel	4 days	2½ days
Speed of propulsion	24,500 m.p.h.	24,000 m.p.h.
Living occupants of projectile... ...	3 men, 2 dogs, chickens	None. (Russian sputnik III, 2 dogs)
Cost	$5½m	$3m

CORRESPONDENCE

Airliner Paint Schemes

WITH reference to Roger Bacon's mention of aircraft paint schemes ("Straight and Level," *Flight*, October 17), I think it can be said that this company agrees with his sentiments, as is evidenced by the colour scheme we adopted at the beginning of the year when we took delivery of our Viscount 805s.

This comprises maroon roof divided by white cheat-line from grey window-line with EAGLE AIRWAYS in white on the red above the windows and the Eagle symbol fore and aft.

Incidentally, all our aircraft carry the Civil Air Ensign, as we believe this to be more correct than the more generally used Union Jack.

With the interior décor of this aircraft we have endeavoured to break away from the traditional rather cold look by adopting grey carpet, maroon seats with white nylon headrests, and white roof with pink and grey panels depicting the various eagles of ornithology. The curtains are maroon with gold thread.

London, W.2. GEOFFREY W. PITT,
Director, Eagle Aviation, Ltd.

Air Victory Scores

I THINK Michael Unsworth's letter (October 17) about air victory scores is one that merits considerable attention and further discussion. First, I quite agree with him in regard to Col. Walker Mahurin and I hope Mahurin will feature in the forthcoming books *American Aces of World War II* and *Thunderbolt*. Although I have been collecting data about air scores in both wars for some years now, there are many incidents I would like to know more about, particularly those of an unusual nature. In the main, fighters fought fighters or bombers because there were more of them. But what about the unusual types, such as the Austrian aircraft on the Italian front in the 1914-18 war? Furthermore, how many aircraft did the aces Linke-Crawford and Banfield shoot down—and did they at any time pilot the Brandenburg Star Strutter?

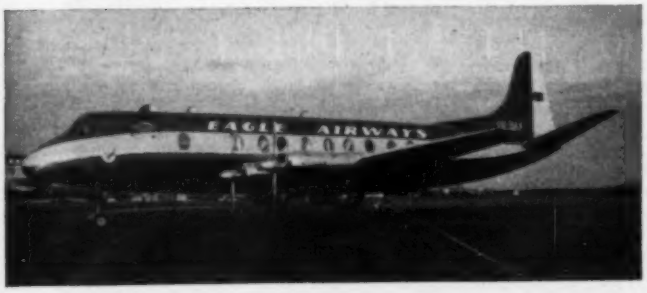
Again, am I right in thinking that among Oblt. Christiansen's score was a Handley-Page 0/100 bomber and a R.N.A.S. blimp? Of great interest are the enormous scores of German day and night fighters in the Hitler war compared with the modest British claims. While the German scores ran into hundreds with Maj. Hartmann's claim of 336 heading the list, our own top-scorer, G/C. Johnnie Johnson, could claim only 38.

The only conclusion is that we had very many pilots who shot down on average about 20 enemy aircraft. However, I am not satisfied with the British scores, which seem to disregard flying bombs. If they were included, then S/L. J. Berry would be our leading ace, for besides shooting down piloted aircraft he also destroyed 61½ flying bombs. Once again I would like to know how many Allied pilots shot down a six-engined Blohm und Voss Bv 222 or six-engined Messerchmitt Me 323 transports? So far I have only one account of an Me 323 transport being shot down—incidentally by a Martin Marauder piloted by W/C. Maydwell. Did any British pilot manage to shoot down a five-engined Heinkel He 111Z twin-fuselage glider tug or one of those FW190/Ju88, Me 109/He 111 combinations? Also, I have yet to hear of a Fieseler Storch being shot down. (I think the answer could be found in the combat reports of the D.H. Mosquito intruders who roamed deep into Germany.)

One last question: To what extent did individual colour schemes occur in the Luftwaffe? W/C. R. P. M. Gibbs, D.S.O., D.F.C., V.C., mentions being attacked by red Me 109s with yellow noses, and Clostermann describes the fight between Lt. Martell and Maj. Von Graff, who flew a yellow FW190. I have also found reference to a pure-white Me 109 and an all-black one.

Birmingham, 14. MAURICE AUSTIN.

The Viscount paint-scheme described above by Mr. G. W. Pitt



Supersonic Fare-differentials?

THE members of I.A.T.A. meeting in Cannes have been discussing the problem of fare-differentials for turboprop and turbojet aircraft, but have they considered the problems that will arise with the introduction of supersonic airliners? I doubt if there is an airline in the world which would not ask for a rise in fares to operate aircraft whose costs will probably be 20-25 per cent higher than those for subsonic ones. Nor can I see government agencies allowing a sudden fare-jump of that magnitude. The only solution then will be to have a fare-differential. Since in both these cases the speed is the quality which is being affected, the treatment must be the same, and a differential based on that difference in quality must be allowed.

Walton-on-Thames, Surrey. JEREMY BANHAM.

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Straight and Level

THREE times in six months civil airliners have been smashed out of the sky by jet fighters. Last April, an F-100F hit a United Air Lines DC-7 on an airway over Las Vegas. The following month a T-33 hit a Capital Airlines Viscount on an airway over Baltimore. Last week a Sabre hit a B.E.A. Viscount on an airway between Rome and Naples. In each airliner everybody was killed.

You can read on another page the views of the Guild of Air Traffic Control Officers, whose second convention—by a curious irony—took place the day after the latest collision. Mark their words, and recall that the Guild spoke thus two long years ago.

With renewed force I should like to repeat remarks made previously in these pages. First, I believe that the ultimate answer—the only answer—to the collision menace is *joint* control of military and civil air traffic. Second, the "see-and-be-seen" principle of air navigation as a primary method of avoiding collision is as dead as the many conscientious airmen it has so far killed. (The commander of the Viscount, Capt. Frank Foster, was — by another ironic coincidence—a member of the airways committee of the British Gliding Association, which is concerned with the conflicting interests of those who use the air). Third, it is dangerously misleading to rely for safety upon better cockpit visibility, or flashing lights, or automatic collision-avoidance radar, or "swivel-necking" by pilots. All these things are necessary, but they are not the answer.

The answer is to do what America has done. So shocked were Americans by the two collisions last spring that they stopped talking about the need for the unified civil-military control of congested airspace, and did something about it. They created a new Federal Aviation Agency, charged it with the unified control of all air civil and military traffic, and put a civilian—formerly an Air Force general—at the top. This is how European nations must act, and they must act very quickly indeed.

● Just for the record, was it B.O.A.C. or Pan American who first advertised "First Jet Services Across the Atlantic"? Most people, recalling the provocative full-page Pan American advertisements splashed in the British daily papers of September 17, would say that it was the American airline. And most people would say that it was these advertisements which really made B.O.A.C. determined to be first.

Yet it is an historical fact that the *New Yorker* for September 13—four days before the PanAm advertisements appeared in London—carried a B.O.A.C. Comet 4 advertisement claiming the "First Jet Service Across the Atlantic." It doesn't matter now, though future historians might make a note.

● When the U.S. Navy produces figures to show that, thanks to the angled deck and the mirror sight, its carrier landing accident rate has been cut from 30 to 8 per 10,000 touchdowns, at a saving of some fifty million dollars per year, there can be no doubt at all that the high honours recently bestowed by the U.S. Government on the British inventors of these devices, and of the steam catapult, were indeed well earned. "Exceptionally meritorious conduct in the performance of outstanding services," as the citations put it, seems almost an understatement.

I wonder when Britain will get round to honouring these men for their achievements.

New-style thermal-seeking technique employed by Derbyshire glider pilots: (1) Use navigational assistance of fair Baroness in right-hand seat. (2) Use extra know-how of keen young falcon on left-hand hand. The demonstration above is by pilot-falconer-schoolteacher Tim Bowles; Baroness Ariane von Vever Neumark; and Bowles' merlin falcon, which answers to the name Pallas Athene.

● Talking of the invention of the mirror sight, I'll bet not many people have heard of the significant part played by a certain Miss Montgomery in the origin of this aid. As a matter of fact, Miss Montgomery carried out the first-ever test of the practicability of the system. It happened at Admiralty, where she was secretary to Captain D. R. F. Cambell, under whom Lt-Cdr. H. C. N. Goodhart was working. The year was 1951. Now read on.

To prove to his boss that the system which he had just invented really worked, Lt-Cdr. Goodhart arranged a demonstration in Capt. Cambell's office. Essential props included a model aircraft carrier and Miss Montgomery. The young lady was first asked for the loan of a torch, her powder compact and her lipstick. She was then asked to walk forward, keeping the reflection of the torch-light in line with a lipstick mark across the centre of her compact mirror. And, in the words of an official account, "the possibilities of the scheme were proved when her chin ended up on the model round-down."

● I quote from an editorial on Comet 4 Atlantic services appearing in the *Newark Evening News*: "Great Britain had this victory coming. It was England's Sir Frank Whittle who gave both Great Britain and the United States the jet engine we know today. And it was Great Britain which pioneered in jet transportation six years ago with the original Comets."

In adding that the Newark is the one in New Jersey I shall not demur from the sentiments of the American reader who sent me the clipping "to demonstrate that your American cousins can pay a tribute graciously."

● Yet another plea for some new British light aircraft has been made, this time by the Lancashire Aero Club in the current issue of their magazine, *The Elevator*. The average age of light aircraft on the British register is approximately 21 years, the club avers, and the total combined age of all light aircraft in this country is something like 17,000 years. "Now," the journal asks, "don't you believe we ought to have some new ones? This country must be a vast aeronautical museum."

Under the journal's heading "Agony Column" appear photographs of smooth and shiny U.S. aircraft—Tri-Pacer, Apache, Skylane, Cessna 310B, Bonanza, Twin Bonanza, Comanche and Travel-Air—followed by a picture of the faithful Tiger Moth. Apt caption to the Tiger reads: "You look older, honey!"

● The Americans deserve full marks for making the most of their products. I have just been reading Department of Commerce report PN 131162, "An Evaluation of Popcorn as a Cushioning Material." Unfortunately its performance was not good enough for packaging the most delicate airborne equipment. I expect much greater things from bubblegum and Mom's pan-fried mush as a tank-sealant, or Southern fried chicken as an average bird for windscreen impact studies.

● Remember this when you are next coming in to land. According to the Flight Safety Foundation of New York —whose worthy motto is Share Your Experience—"Normal landing in a 14,000 lb aircraft at the recommended 120 kt I.A.S. produces a kinetic energy at touchdown of 8.95 million ft-lb—enough to knock a seven-ton elephant 638ft straight up."

. ROGER BACON

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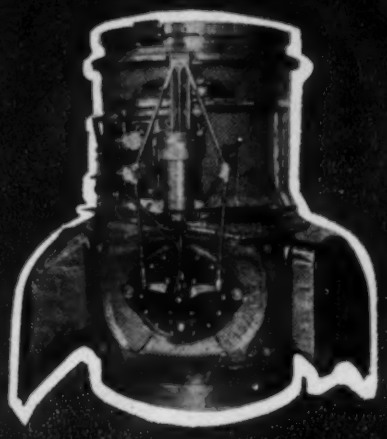
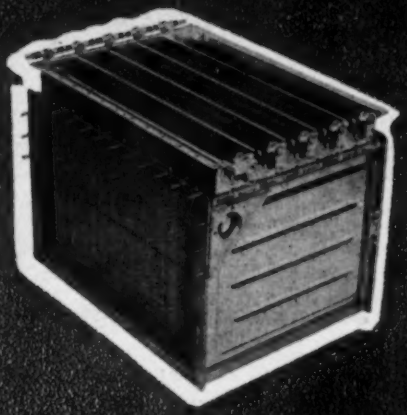


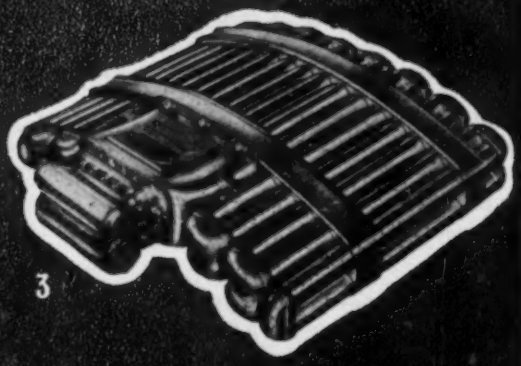
1

These thermal blankets are made of refractory fibre cased in .004 inch (.1016 mm) stainless steel. They are made-to-measure and are extremely light, the dimpled construction being responsible for their great strength. Specified for Rolls-Royce and Armstrong Siddeley jet and turbo-prop engines, these particular examples are shown fitted to the Rolls-Royce thrust reverser for the de Havilland Comet.



2

We design, manufacture and supply heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Argosy, the Vickers Viscount and the Handley Page Herald.



3

High pressure fuel-cooled oil cooler for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.

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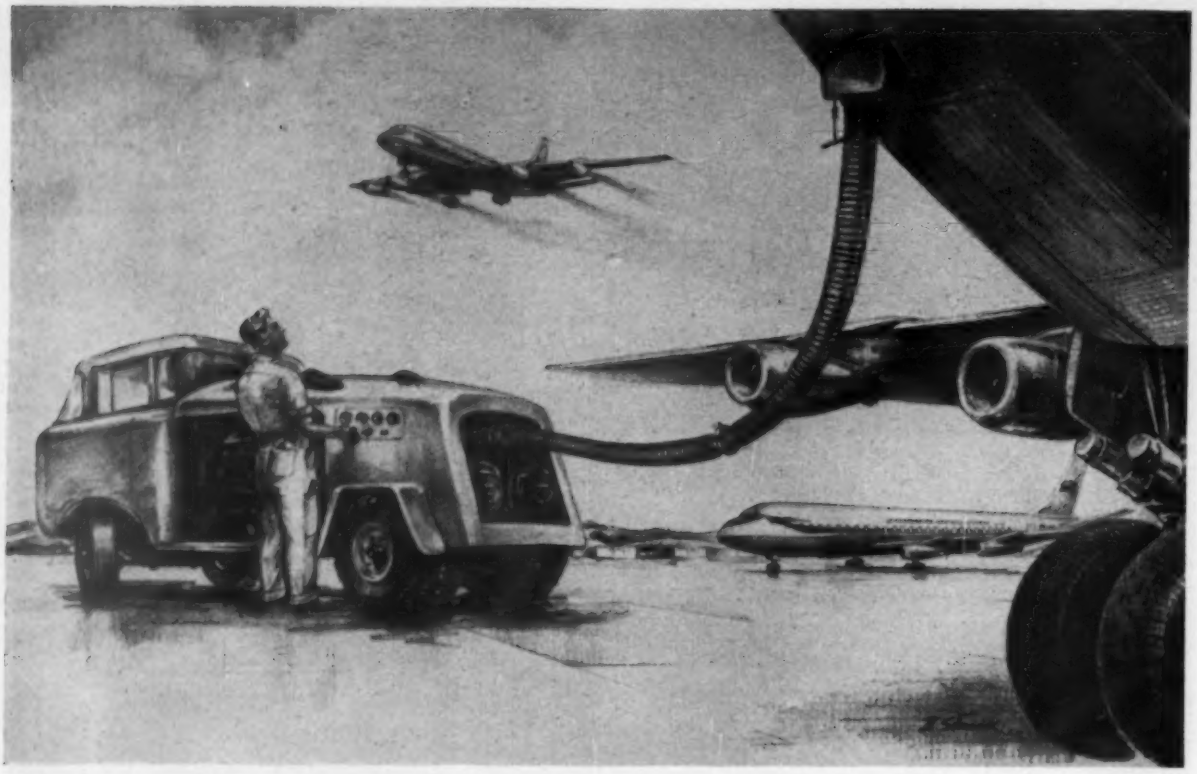

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Scandinavian Airlines System will use 10 Atlas Copco 'Air Partner' compressors to service their fleet of DC-8 jet airliners

STARTING · AIR CONDITIONING · DE-ICING

The Air Partner is a surge-free rotary screw compressor of the Lysholm type designed for starting, air conditioning and de-icing all jet and turbo-prop airliners having air turbine starters.

A SUCCESSFUL COMBINATION

Atlas Copco, the world's largest organisation devoted exclusively to the manufacture of compressed air equipment, combined aeronautical expertise with compressor know-how to produce this multi-purpose unit.

STARTING

The Air Partner delivers a continuous flow of warm, oil-free air to turn the engine over constantly thus eliminating mis-starts.

AIR CONDITIONING

The Air Partner becomes an air conditioning unit by merely flicking the appropriate switches and pressing a button, a matter of seconds.

DE-ICING

A special mouthpiece attached to the air hose enables the wings and fuselage to be 'sprayed' with warm air. Removal of ice and sleet from windshields, wing leading edges, and air intake lips is achieved by using the ordinary de-icing outlets of the aircraft.

SIMPLE MAINTENANCE

The Air Partner has no wearing parts. It consists of two screw rotors which intermesh but never touch one another or the casing. 10,000 hours is the normal period between overhauls for screw compressors of this type.

Maintenance operations can be carried out by airline personnel anywhere in the world or through the Atlas Copco sales and service organisation established in 90 countries.

TWO MODELS

Air Partner M-3 consists of two identical units, each including a compressor connected to a standard petrol or diesel engine, for starting, air conditioning, de-icing and checking auxiliary systems.

Air Partner M-2 consists of one rotary screw compressor connected to a standard petrol or diesel engine for starting and limited air conditioning.

THE *Atlas Copco* AIR PARTNER

A contribution to the jet age of air travel

Contact your local Atlas Copco company or agent or write to Atlas Copco AB, Stockholm 1, Sweden.

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The glass-laminate moulds used in the manufacture of Bristol "fluted-core" radomes, as described in column 2

The Industry's Balance-Sheets

NOT unexpectedly, the uncertainties of the position of the British aircraft industry are beginning to be reflected in the trading accounts of the major constructors. Three companies have lately published figures, summaries of which are given below.

Fairey Aviation group trading profits for the year ended March 31 rose from £2.1m to £2.2m. The small increase, however, was more than offset by heavier taxation charges (£1.3m as against £1.1m) and after allowing for minority interests net profits fell by £33,000 to £960,228.

Profits for any particular year relate not only to deliveries completed that year but also to earlier deliveries for which final prices had not previously been established. Trading profits on earlier deliveries accounted for about £1.9m last year as against £1.2m in the year ended March 31, 1957.

Folland Aircraft experienced a fall in net profit for the year ended June 30 from £31,315 to £5,221. Trading profits in the previous year were raised by inclusion of £77,537 in respect of insurance claims.

Prior to June 1956 the company wrote-off development expenditure as incurred. Such expenditure has subsequently been carried forward in part against future contracts: the accumulated value of these deferred charges increased last year from £335,708 to £435,828.

At the a.g.m., to be held on December 19, the directors will recommend that no ordinary dividend be paid. In the year ahead the company's position is expected to improve as Gnat delivery moves under way.

Westland Aircraft have some encouraging results. A rise in group net profit for the year ended June 30, from £567,885 to £630,268, provides justification for the chairman's belief, stated last year, that the company could "look to the future with reasonable confidence." Taxation increased sharply from £547,125 to £773,733: the increase in gross profits (from £1.1m to £1.4m) was a remarkable 25 per cent.

At the a.g.m., to be held on November 20, the directors will propose a tax-free dividend of 6 per cent on share capital of £2.7m, the present capital (£2.25m) being increased by a free scrip issue.

Esso's New Research Facility

ON October 20 the new Esso research laboratories near Abingdon, Berks, were opened by Lord Hailsham, Lord President of the Council. The largest research centre operated by the company in the Eastern Hemisphere, the new establishment will serve not only the Esso Petroleum Co. in the United Kingdom but also its subsidiaries in Europe and North Africa.

It was in the original prefabricated buildings which stood on the site of the laboratories that—in the company's words—"Esso scientists discovered the formula for the only oil capable of lubricating such aircraft as the Comet and Viscount and all high performance military jet aircraft."

Equipment for testing by radioactive methods includes cylinder liners for studying the effect of lubricant quality on engine wear, and apparatus for determining sulphur content, using tritium as the source of gamma rays.

THE INDUSTRY

"Fluted Core" Radomes

THE four long-range Britannias soon to be delivered to Compañia Cubana de Aviacion will be fitted with glass-fibre radomes manufactured by the new Bristol "fluted-core" process. The collision-warning radars for these aircraft differ from those at present in service with Britannias which use the X-band frequency; the Cubana equipment will operate on the C-band frequency in general use in the U.S.A. Tests carried out by a radar equipment manufacturer, state Bristol Aircraft, show that the new radomes are the most satisfactory yet examined by them for C-band operation.

The fluted-core construction consists basically of two outer walls moulded integrally with intermediate corrugation or cells. The sandwich is made up by laying glass in the mould and packing flexible wax mandrels or formers, wound with glasscloth tape, between the separate surfaces of the two skins.

After the resin has been injected the tool is opened and the moulding removed to an oven for the post-curing of the laminate and the melting out of the wax mandrels.

In the case of the radome, the outer skin of glasscloth is laid up in the female half of the mould, and the inner skin laid up on the male mould, which is then located into position. Clamping bolts lock the halves together and resin is then injected under pressure from the bottom of the mould.

The radome is made up with a cold-setting resin and is therefore allowed to cure in the tool before post-cure treatment in an oven.

This method of construction, say Bristol, offers certain advantages over earlier construction processes. In the first place, fluted-core radomes can be produced at considerably less cost; and, secondly, as the radomes are moulded integrally they are much stronger than "built-up" structures, have much higher resistance to impact damage, and can be consistently moulded to far finer limits of dimensional accuracy.

IN BRIEF

Keelavite Hydraulics, Ltd., is the new name adopted by Keelavite Rotary Pumps and Motors, Ltd. Address and telephone number are unchanged.

* * *

At the recent Brussels international exhibition, British Timken, Ltd., gained a grand prix award for the best precision mechanics exhibit, on the company's stand in the British pavilion.

* * *

An informative and well illustrated booklet on small transformers, chokes and coils has been published by the transformer section of Haynes Radio, Ltd., Queensway, Enfield, Middx.

* * *

Appointed assistant sales engineering manager of Avro Aircraft, Ltd., Malton, Ont, Mr. William C. Walter was a project officer with the U.S.A.F. Research and Development Command Space Systems Office before joining the company.

* * *

Mr. R. W. Jay, formerly assistant commercial manager (Britannia), has been appointed spares manager of Bristol Aircraft, Ltd., in succession to Mr. C. A. R. Biddle, who is taking up an appointment with Tube Products, Ltd., of Oldbury, Birmingham.

* * *

Mr. Geoffrey R. Simmonds was recently elected president and a director of Simmonds Aerocessories, Inc., Tarrytown, N.Y. He fills the vacancy caused by the death of Mr. William R. Enyart, who had been president since 1940, in the KC-135 accident last June at Westover A.F.B., Mass.

* * *

Describing the whole range of Thorn electrical and electronic components for use in the aircraft and other industries, an attractive and comprehensive catalogue (with five colour-coded sections) has been produced by the aircraft components and connector division of Thorn Electrical Industries, Ltd., Great Cambridge Road, Enfield, Middx.

Described as "the largest heat-shroud in the world," this Delaney Gallay product for the Vickers Vanguard is over 13ft long and gives 48 sq ft of insulation yet weighs only 34½ lb. Made of Thermoflex R.F.300 between sheets of dimpled 0.004in stainless steel, it shields the fuel tanks from jet-pipe heat

The Aeronautical Bookshelf

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The impact of engineering upon air fighting is overlooked. The authors seem unaware that the fighting potential of the "Flying Circus" was repeatedly curtailed by deficiencies of equipment. They miss, too, the point that von Richthofen, as well as Boelcke, directly endeavoured to influence development and selection of the equipment. There is also an implication that impending rearmament with the Fokker DVII spread gloom, and that the Rittmeister was tending to seclude himself because of a premonition of his approaching death. Nonsense! The DVII was most eagerly awaited; and when the present writer last saw von Richthofen, only a day or two before his end, he was happily exercising his new mount, displaying it with pride around neighbouring airfields. Incidentally, and contrary to statements in the book, the famous pilot's Fokker triplanes and their weapons were always of standard type and materials; and Oberursel-built rotary engines were *not* fitted.

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In the field of aircraft armaments the authors seem to be equally at sea. A "Spandau" gun never existed. A list of several types of machine-gun (p. 48) may give the innocent reader an impression of the authors' profound knowledge of the subject; yet at the relevant period the particular weapons mentioned were either long-discarded or had yet to be invented.

An assertion (p. 79) that von Richthofen might have been making use of explosive bullets—contrary to the Hague Convention—is a grotesque one; what the authors meant was tracer bullets; and their description of the action of this ammunition is ballistically highly original. There is, too, some unintentional humour—as, for instance, the mention of "the Iron Cross (Third Class)"; such an award, one feels, would have been for sub-humans, as the second class was already low enough in value. On another page the derogatory word *Kommiss* is interpreted as "soldier-like qualities," whereas it actually signifies boorish, brusque barrack-square manners. And to let fighter pilots mount to their cockpits by wooden step-letters at least gives credit to the author's inventiveness!

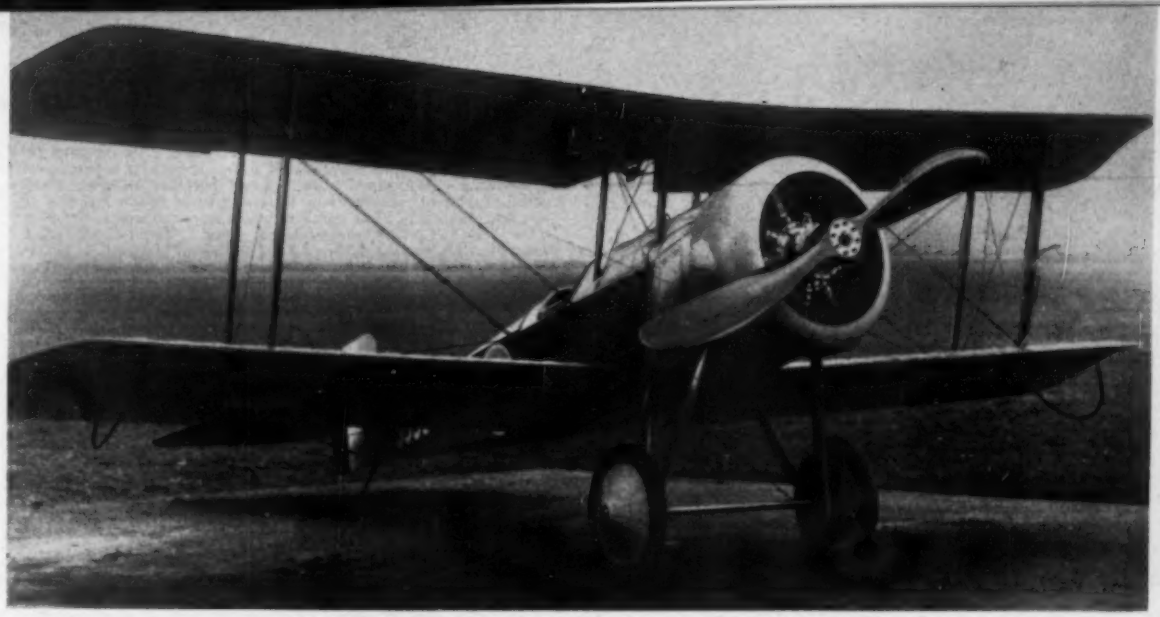
Without doubt, the data-lists and many of the drawings are the result of careful and painstaking research. The three-view drawings of aircraft, too, will delight aeromodellers, though even these show a certain lack of acquaintance with first-hand contemporary documentation; none of the aerofoil sections ascribed to specific types, for instance, can claim resemblance to actuality.

Many will admire the book, and for aeromodellers, as has been said, it can be recommended; but one fears that it may in time come to be quoted as a "bible" in argument against those who treasure first-hand knowledge and nostalgic memories of von Richthofen and his squadron. A. R. W.

British Naval Aircraft 1912-58, by Owen Thetford. Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1. Price 50s. Illustrated.

A SHELF companion to Mr. Thetford's earlier work, *Aircraft of the Royal Air Force*, this book resembles it in format and character; which means that it is an attractive and valuable work—especially so as it contains a considerable amount of hitherto unpublished material. Some 350 types and sub-types of aircraft are reviewed, at length or in brief paragraphs; yet while such obscure types as the Alcock Scout are included, the D.H.9a and Avro 504N, both of which were quite regularly deck-landed at one period or another, are not. (The carrier-borne "9a" had detachable wings and slinging gear.)

Notwithstanding its occasional factual errors, the book is one that can be warmly recommended for study and pleasure. It is another timely, well presented example of the work of the new generation of British aeronautical archivists. H. F. K.



R.N.A.S. Scout D, N.5393, with 100 h.p. Monosoupape engine and bulged cowling

THE BRISTOL SCOUT

HISTORIC MILITARY AIRCRAFT No. 18 PART V By J. M. BRUCE, M.A.

SEVERAL Bristol Scouts went to training aerodromes overseas. It has already been mentioned that the type was used by the 20th (Reserve) Wing, R.F.C., at Abu Qir in Egypt. The Wing was formed in September 1916 by grouping the reserve squadrons Nos. 21, 22 and 23; No. 21 was located at Abbassia, but the others were at Abu Qir.

At least one Scout D, No. 8976, was sent to Australia. What it did there has not been recorded, but it probably found its way to the Australian Flying Corps Central Flying School at Point Cook.

A number of R.N.A.S. Scouts D were sent to the Vendôme School in France. That R.N.A.S. training unit was opened at Vendôme, west of Orleans, in November 1916. It owed its existence to the bad weather of the winter of 1915-16, which had seriously interfered with flying training in the United Kingdom; consequently a new site for a training aerodrome was sought in an area where good flying weather might reasonably be expected. It was intended that, ultimately, R.F.C. pilots should also be trained there. The Bristols sent to Vendôme included N.5411, N.5412, and N.5413.

One example of the Bristol Scout went to America in 1918. The aircraft was B.763, a rebuilt Scout D assembled by No. 1 (Southern) Aeroplane Repair Depot. It was sent to McCook Field, where it had the project number P-32. As flown there, B.763 had an 80 h.p. Le Rhône engine, and four large holes were made in the front of the cowling to aid cooling. The aircraft had no wing-tip skids. Apparently it survived until 1921 at least, for on April 30, 1921, it was sent to Wilbur Wright Field.

As the war progressed, the numbers of surviving Bristol Scouts became smaller and smaller. The fewer they became the more assiduously were they pursued by senior officers for their personal use, for the little Bristol enjoyed a popularity similar to that of the Sopwith Pup. Its flying qualities were almost irreproachable, and (to quote Oliver Stewart) "a pilot who was able to secure one of these aeroplanes was looked upon with envy by all other pilots, and he would take very good care that his 'training' machine was never used for training and that no pilot but himself ever went near it."

THE author desires to record his gratitude to the Bristol Aeroplane Co., Ltd., and in particular to C. H. Barnes of Bristol Aircraft, Ltd., for the assistance they have given in the preparation of this history.

Yet only one survived the war to fly in peace-time. The civil registration G-EAGR concealed the identity of No. 5570, a Scout C whose first owner was Maj. J. A. McKelvie. In 1926 it was bought by S/L. Champion de Crespigny, who sold it to F/L. A. M. Wray in the following year. It was flown as a sporting single-seater at various R.A.F. stations and ended its career on a scrap-heap at North Cave, Yorkshire.

Twenty years ago Oliver Stewart wrote (in *The Clouds Remember*):—

"I have often wondered how a modern flying club would appreciate a Bristol Scout with 80 h.p. Le Rhône or a Sopwith Pup with 80 h.p. Le Rhône. I believe that these machines would exercise today over the members of a flying club just as strong a fascination as they exercised over the Royal Flying Corps and Royal Naval Air Service pilots during the war. They were both great flying machines, and although of the two the Sopwith Pup was probably superior, they both gave their pilots the authentic sensations of man-controlled flight in a way that few, if any, other machines have ever done."

That paragraph might equally well have been written today. And, happily, there is hope that today's generation may yet have the opportunity of experiencing the particular fascination that was exercised by the Bristol Scout.

SPECIFICATION AND SUMMARY

Manufacturers: The British and Colonial Aeroplane Co., Ltd., Filton, Bristol; production at Brislington.

Powerplants

Scout A: 80 h.p. Gnôme, later 80 h.p. Le Rhône. *Scout B:* 80 h.p. Gnôme. *Scout C:* 80 h.p. Gnôme, 80 h.p. Le Rhône, 80 h.p. Clerget, 110 h.p. Clerget. *Scout D:* 80 h.p. Le Rhône, 100 h.p. Gnôme Monosoupape, 80 h.p. Gnôme, 110 h.p. Le Rhône.

Dimensions

Scout A: Span originally 22ft, later 24ft 7in; length 19ft 9in; chord originally 4ft, later 4ft 6in; stagger 1ft 4in; span of tail 8ft; wing area 161.5 sq ft.

Scout B: Span 24ft 7in; length 20ft 8in; height 8ft 6in; wing area 198 sq ft.

Scouts C and D: Span 24ft 7in; length 20ft 8in; height 8ft 6in; chord 4ft 6in; gap 4ft 3in; stagger 1ft 4½in (Scout C), 1ft 9in (Scout D); span of tail 10ft (Scout D); dihedral 1 deg 45 min (Scout C), 3 deg (Scout D); incidence 2 deg (Scout C), 2 deg 30 min (Scout D); wing area 198 sq ft.

[*Data continued overleaf*

Weights and Performance

Aircraft	Scout A	Scout C			Scout D
Engine	80 h.p. Gnôme	80 h.p. Le Rhône	80 h.p. Clerget	110 h.p. Clerget	80 h.p. Le Rhône
Weight empty (lb)	617	757	750	926	760
Military load (lb)...	—	80	Nil	73	60
Pilot (lb)	—	180	170	160	180
Fuel and oil (lb) ...	—	178	169	256	200
Weight loaded (lb)	957	1,195	1,089	1,415	1,250
Max. speed (m.p.h.) at ground level...	95	92.7	93.8	107.3	100
5,000ft	—	90.5	—	108	94
10,000ft	—	86.5	—	—	86
Climb (min and sec) to:					
1,000ft	1 15	0 55	1 38	1 00	— —
5,000ft	— —	7 00	8 05	6 30	— —
10,000ft	— —	21 20	27 30	18 15	18 30
Service ceiling (ft)	—	15,500	11,000	14,000	—
Endurance (hr) ...	3	2½	2	2½	—

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It would not be difficult, did space permit, to quote at least 40 inaccuracies of various degrees of seriousness. Taking a few at random, there is the implication (p. 148) that four-cylinder engines were used in Albatros aircraft during the war; in fact they had been abandoned for military use in 1913. The *Prüfanstalt und Werft*, a test-and-approval department to which von Richthofen was said (p. 92) to be giving his expert advice in January 1918, had actually ceased to exist two years earlier. No Albatros CIII could possibly have flown at the front (p. 21) during September-October 1915, and the Fokker E.II (p. 22) was definitely *not* "an enlarged version of the E.I." No Albatros DIII ever reached 115 m.p.h. (p. 169), and an alleged "Albatros" illustrated on p. 75 happens to be the first Pfalz DIII to reach the unit. Serial No. D.4253/18 flown by Udet was not (as stated on p. 131) a Fokker parasol but a standard Fokker DVIIF biplane.

In the field of aircraft armaments the authors seem to be equally at sea. A "Spandau" gun never existed. A list of several types of machine-gun (p. 48) may give the innocent reader an impression of the authors' profound knowledge of the subject; yet at the relevant period the particular weapons mentioned were either long-discarded or had yet to be invented.

An assertion (p. 79) that von Richthofen might have been making use of explosive bullets—contrary to the Hague Convention—is a grotesque one; what the authors meant was tracer bullets; and their description of the action of this ammunition is ballistically highly original. There is, too, some unintentional humour—as, for instance, the mention of "the Iron Cross (Third Class)"; such an award, one feels, would have been for sub-humans, as the second class was already low enough in value. On another page the derogatory word *Kommiss* is interpreted as "soldier-like qualities," whereas it actually signifies boorish, brusque barrack-square manners. And to let fighter pilots mount to their cockpits by wooden step-letters at least gives credit to the author's inventiveness!

Without doubt, the data-lists and many of the drawings are the result of careful and painstaking research. The three-view drawings of aircraft, too, will delight aeromodellers, though even these show a certain lack of acquaintance with first-hand contemporary documentation; none of the aerofoil sections ascribed to specific types, for instance, can claim resemblance to actuality.

Many will admire the book, and for aeromodellers, as has been said, it can be recommended; but one fears that it may in time come to be quoted as a "bible" in argument against those who treasure first-hand knowledge and nostalgic memories of von Richthofen and his squadron. A. R. W.

British Naval Aircraft 1912-58, by Owen Thetford. Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1. Price 50s. Illustrated.

A SHELF companion to Mr. Thetford's earlier work, *Aircraft of the Royal Air Force*, this book resembles it in format and character; which means that it is an attractive and valuable work—especially so as it contains a considerable amount of hitherto unpublished material. Some 350 types and sub-types of aircraft are reviewed, at length or in brief paragraphs; yet while such obscure types as the Alcock Scout are included, the D.H.9a and Avro 504N, both of which were quite regularly deck-landed at one period or another, are not. (The carrier-borne "9a" had detachable wings and slinging gear.)

Notwithstanding its occasional factual errors, the book is one that can be warmly recommended for study and pleasure. It is another timely, well presented example of the work of the new generation of British aeronautical archivists. H. F. K.

R.N.A.S. Scout D, N.5393, with 100 h.p. Monosoupape engine and bulged cowling

THE BRISTOL SCOUT

HISTORIC MILITARY AIRCRAFT No. 18 PART V By J. M. BRUCE, M.A.

SEVERAL Bristol Scouts went to training aerodromes overseas. It has already been mentioned that the type was used by the 20th (Reserve) Wing, R.F.C., at Abu Qir in Egypt. The Wing was formed in September 1916 by grouping the reserve squadrons Nos. 21, 22 and 23; No. 21 was located at Abbassia, but the others were at Abu Qir.

At least one Scout D, No. 8976, was sent to Australia. What it did there has not been recorded, but it probably found its way to the Australian Flying Corps Central Flying School at Point Cook.

A number of R.N.A.S. Scouts D were sent to the Vendôme School in France. That R.N.A.S. training unit was opened at Vendôme, west of Orleans, in November 1916. It owed its existence to the bad weather of the winter of 1915-16, which had seriously interfered with flying training in the United Kingdom; consequently a new site for a training aerodrome was sought in an area where good flying weather might reasonably be expected. It was intended that, ultimately, R.F.C. pilots should also be trained there. The Bristols sent to Vendôme included N.5411, N.5412, and N.5413.

One example of the Bristol Scout went to America in 1918. The aircraft was B.763, a rebuilt Scout D assembled by No. 1 (Southern) Aeroplane Repair Depot. It was sent to McCook Field, where it had the project number P-32. As flown there, B.763 had an 80 h.p. Le Rhône engine, and four large holes were made in the front of the cowling to aid cooling. The aircraft had no wing-tip skids. Apparently it survived until 1921 at least, for on April 30, 1921, it was sent to Wilbur Wright Field.

As the war progressed, the numbers of surviving Bristol Scouts became smaller and smaller. The fewer they became the more assiduously were they pursued by senior officers for their personal use, for the little Bristol enjoyed a popularity similar to that of the Sopwith Pup. Its flying qualities were almost irreproachable, and (to quote Oliver Stewart) "a pilot who was able to secure one of these aeroplanes was looked upon with envy by all other pilots, and he would take very good care that his 'training' machine was never used for training and that no pilot but himself ever went near it."

THE author desires to record his gratitude to the Bristol Aeroplane Co., Ltd., and in particular to C. H. Barnes of Bristol Aircraft, Ltd., for the assistance they have given in the preparation of this history.

Yet only one survived the war to fly in peace-time. The civil registration G-EAGR concealed the identity of No. 5570, a Scout C whose first owner was Maj. J. A. McKelvie. In 1926 it was bought by S/L. Champion de Crespigny, who sold it to F/L. A. M. Wray in the following year. It was flown as a sporting single-seater at various R.A.F. stations and ended its career on a scrap-heap at North Cave, Yorkshire.

Twenty years ago Oliver Stewart wrote (in *The Clouds Remember*):—

"I have often wondered how a modern flying club would appreciate a Bristol Scout with 80 h.p. Le Rhône or a Sopwith Pup with 80 h.p. Le Rhône. I believe that these machines would exercise today over the members of a flying club just as strong a fascination as they exercised over the Royal Flying Corps and Royal Naval Air Service pilots during the war. They were both great flying machines, and although of the two the Sopwith Pup was probably superior, they both gave their pilots the authentic sensations of man-controlled flight in a way that few, if any, other machines have ever done."

That paragraph might equally well have been written today. And, happily, there is hope that today's generation may yet have the opportunity of experiencing the particular fascination that was exercised by the Bristol Scout.

SPECIFICATION AND SUMMARY

Manufacturers: The British and Colonial Aeroplane Co., Ltd., Filton, Bristol; production at Brislington.

Powerplants

Scout A: 80 h.p. Gnôme, later 80 h.p. Le Rhône. *Scout B:* 80 h.p. Gnôme. *Scout C:* 80 h.p. Gnôme, 80 h.p. Le Rhône, 80 h.p. Clerget, 110 h.p. Clerget. *Scout D:* 80 h.p. Le Rhône, 100 h.p. Gnôme Monosoupape, 80 h.p. Gnôme, 110 h.p. Le Rhône.

Dimensions

Scout A: Span originally 22ft, later 24ft 7in; length 19ft 9in; chord originally 4ft, later 4ft 6in; stagger 1ft 4in; span of tail 8ft; wing area 161.5 sq ft.

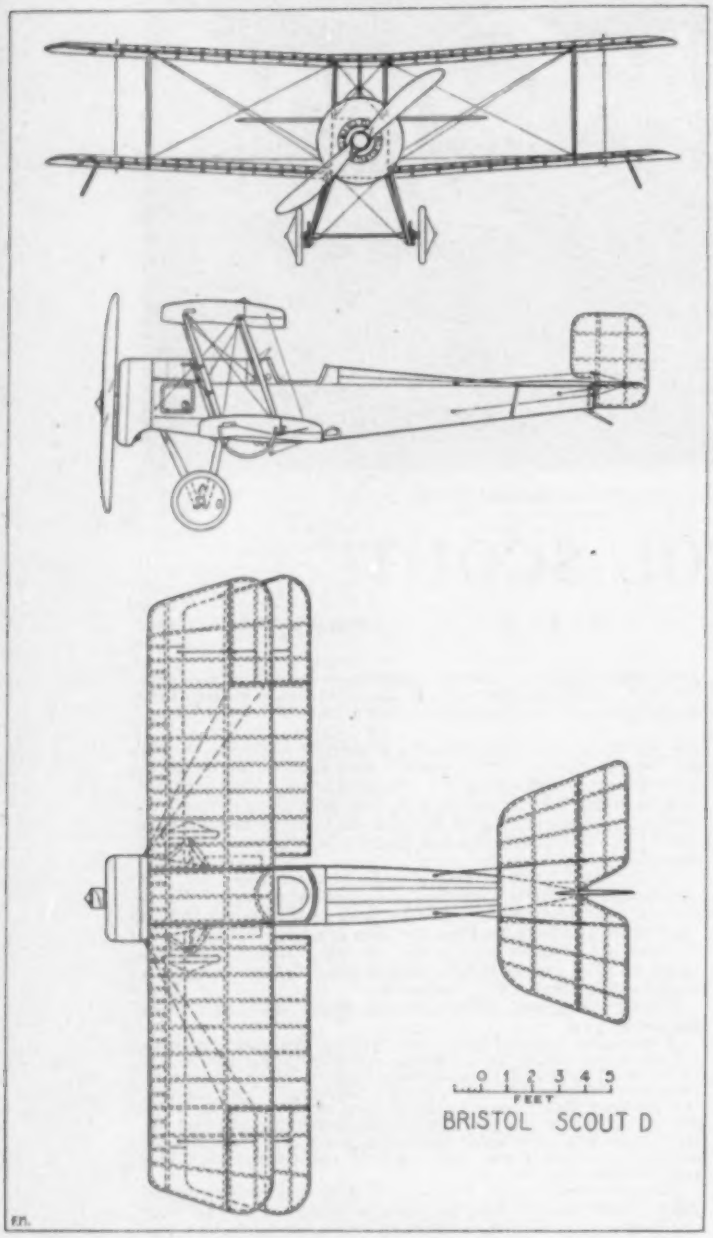
Scout B: Span 24ft 7in; length 20ft 8in; height 8ft 6in; wing area 198 sq ft.

Scouts C and D: Span 24ft 7in; length 20ft 8in; height 8ft 6in; chord 4ft 6in; gap 4ft 3in; stagger 1ft 4½in (Scout C), 1ft 9in (Scout D); span of tail 10ft (Scout D); dihedral 1 deg 45 min (Scout C), 3 deg (Scout D); incidence 2 deg (Scout C), 2 deg 30 min (Scout D); wing area 198 sq ft.

[*Data continued overleaf*

Weights and Performance

Aircraft	Scout A	Scout C			Scout D
Engine	80 h.p. Gnôme	80 h.p. Le Rhône	80 h.p. Clerget	110 h.p. Clerget	80 h.p. Le Rhône
Weight empty (lb)	617	757	750	926	760
Military load (lb)...	—	80	Nil	73	60
Pilot (lb)	—	180	170	160	180
Fuel and oil (lb) ...	—	178	169	256	200
Weight loaded (lb)	957	1,195	1,089	1,415	1,250
Max. speed (m.p.h.) at ground level...	95	92.7	93.8	107.3	100
5,000ft	—	90.5	—	108	94
10,000ft	—	86.5	—	—	86
Climb (min and sec) to:					
1,000ft	1 15	0 55	1 38	1 00	— —
5,000ft	— —	7 00	8 05	6 30	— —
10,000ft	— —	21 20	27 30	18 15	18 30
Service ceiling (ft)	—	15,500	11,000	14,000	—
Endurance (hr) ...	3	2½	2	2½	—



THE BRISTOL SCOUT . . .

Production and Allocation: A total of 374 Bristol Scouts of all sub-types were built: one Scout A, two Scouts B, 211 Scouts C and 160 Scouts D. Of the Scouts C, 137 were delivered originally to the R.F.C. and 74 to the R.N.A.S. Eighty Scouts D with the 80 h.p. Le Rhône engine were originally delivered to the R.F.C.; of the eighty ordered for the R.N.A.S., sixty were intended to have the 100 h.p. Monosoupape, the remainder the 80 h.p. Gnôme. Total original deliveries to the R.F.C. (including the Scouts B) were therefore 219, to the R.N.A.S. 154.

The official statistics quoted in *The War in the Air* show a total of 236 Bristol Scouts distributed to units of the R.F.C., which might be taken to mean that 17 were transferred from the R.N.A.S. to the R.F.C. The 236 Scouts were distributed thus: to R.F.C. units in France, 80; to the Middle East Brigade, 32; to Home Defence units, 9; to training units, 115. No details are known of the distribution of R.N.A.S. Bristol Scouts.

Type Numbers for Bristol aircraft were not introduced until 1923. No Bristol aeroplane of the Great War was known by a type number at the time of its service; there were therefore no letter-number combinations; such designations appear to be of recent invention and have no authenticity. The numbers which were retrospectively allotted to the Bristol Scouts were as follows: Type 1, Scout C with 80 h.p. Gnôme or 80 h.p. Le Rhône; Type 2, Scout D (80 h.p. Gnôme); Type 3, Scout D (80 h.p. Le Rhône); Type 4, Scout D (100 h.p. Gnôme Monosoupape); Type 5, Scout C (110 h.p. Clerget). The Bristol S.2A was Bristol Type 8.

Serial Numbers

Type	Serial Numbers	Contract Numbers	Bristol Works Sequence Numbers
Scout B	633-634	A.2616	229-230
Scout C	1243-1266 1602-1613 3013-3062 4622-4699} 5291-5327} 5554-5603	C.P.67209/14/x A.2824 C.P.74782/15/x A.3242 94/A/319	462-485 450-461 {524-560 {771-783 {486-523 {784-820 1044-1093
Scout D	7028-7057 } A.1742-A.1791} 8951-9000 N.5390-N.5419 A.2376-A.2380	87/A/185 C.P.146161/15/x C.P.130592/16/x Allotted to machines transferred from the R.N.A.S. to the R.F.C.	{1094-1123 {1381-1430 1124-1173 1837-1866

Armament: As described in the main article, a variety of arrangements of armament were fitted to Bristol Scouts. The Scout B of No. 3 Squadron had two rifles, one fixed to each side of the fuselage and firing outwards; No. 5 Squadron's Scout B had a Lee-Enfield rifle mounted on the starboard side of the fuselage (firing outwards and downwards), a Mauser pistol, and five rifle grenades. The Scouts C and D had various arrangements of rifles, carbines or machine-guns. When a Lewis gun was carried it was usually mounted on the starboard side of the fuselage, pointing outwards, or on a home-made mounting above the centre section.

In No. 2 Wing, R.N.A.S., some Scouts had one or two Lewis guns mounted on the upper longerons, firing straight ahead without synchronizing mechanism; in at least one case there was one Lewis gun attached to the port upper longeron and one above the centre section. A few Scouts were armed with a duck gun firing chain shot; others had a 0.45in Martini-Henry rifle firing incendiary ammunition.

R.N.A.S. Bristol Scouts used on anti-Zeppelin duties had two canisters of Ranken darts installed under the pilot's seat; each canister held 24 darts. Some of the Scouts of No. 2 Wing, R.N.A.S., flown from the Isle of Imbros had a rack for four small bombs under the nose.

The ultimate armament of a few R.F.C. Scouts was a single fixed Vickers gun mounted on the port upper longeron and synchronized to fire through the propeller arc. The final batch of Scouts D for the R.N.A.S. had a standard bracket for a Lewis gun above the centre section.

Service Use: *Western Front:* R.F.C. Squadrons Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 21, 24 and 25. *Palestine:* R.F.C. Squadrons Nos. 14, 67 (Australian) and 111. *Mesopotamia:* R.F.C. Squadrons Nos. 30 and 63. *Macedonia:* R.F.C. Squadron No. 47. *Aegean:* No. 2 Wing, R.N.A.S., Isle of Imbros; "A" Flight, R.N.A.S., Isle of Thasos. *Australia:* presumably used at the Australian Flying Corps Central Flying School, Point Cook, Werribee, Victoria. *United Kingdom:* flown operationally by the R.N.A.S. from such aerodromes as Chingford, Cranwell, East Fortune, Great Yarmouth, Port Victoria, Eastchurch and Redcar. Seaplane carrier H.M.S. *Vindex* carried two Bristol Scouts. *Training:* used by many training units, such as No. 34 Reserve Squadron, Orfordness; No. 45 Squadron; training units at Dover, London Colney and Shoreham; 20th (Reserve) Wing, Abu Qir, Egypt; used by the R.N.A.S. for training purposes at the aerodromes named immediately above, and at the R.N.A.S. Flying School, Vendôme, France.

Notes on Individual Machines: Used by R.N.A.S. Great Yarmouth: 1252, 1256 (later to Cranwell). Used at Cranwell: 1256, 1266 (also Port Victoria), 3016, 3041, 3046, N.5403, N.5414. Chingford: 3026, 8988. Eastchurch: 1245, 1249, 1254, 1255 (later to H.M.S. *Vindex*), N.5390. Mudros (No. 2 Wing): N.5393, N.5396. Vendôme School: N.5411, N.5412, N.5413. *H.M.S. Vindex:* 1255, 3028 ("composite" experiment), 8953, 8954, 8955, 8979, 8980 (the last two were the first Bristol Scouts to have machine-guns mounted above the centre section.

Other Machines: 1247: delivered to French Government. 1250: R.N.A.S. Redcar. 3035: 80 h.p. Clerget engine. 3036, 3037 and 3040 were crated for despatch to the Dardanelles. 5324: 20th (Reserve) Wing, R.F.C., Abu Qir. 5554: flown at C.F.S., later fitted with 110 h.p. Clerget. 5555: 110 h.p. Clerget; test-bed for Bristol M.1A power installation. 5556: 110 h.p. Clerget with conical spinner. 5564 and 5565 were transferred from the R.F.C. to the R.N.A.S. 5570: became G-EAGR. 8976: sent to Australia. 8981-8993 and 9000 were diverted to the War Office from the original Admiralty contract, but were later returned to the R.N.A.S. A.1769-A.1772 were transferred from the R.F.C. to the R.N.A.S. N.5394: R.N.A.S. East Fortune.

● *Previous instalments of this article have appeared in the following recent issues of "Flight," all of which are still in print at the time of going to press: September 26 (part I), October 3 (pt. II), October 17 (pt. III), October 24 (pt. IV).*

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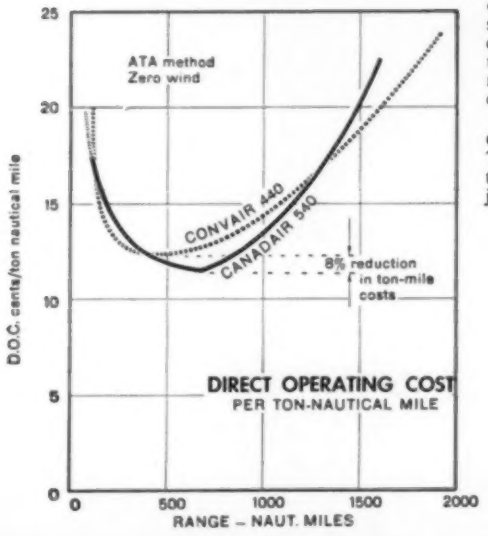
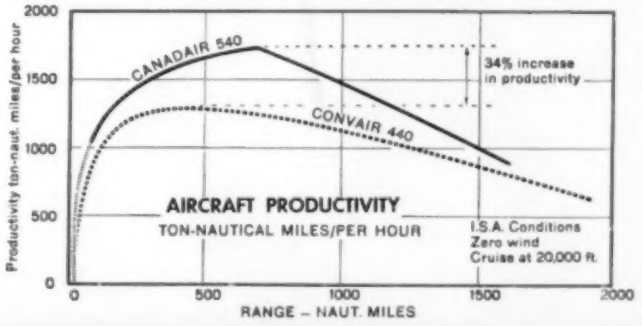


Graph at left, based on the ATA formula, shows that the direct operating costs of the "540" are as much as 8% lower than the "440". This applies particularly on stages over 400 miles; under 400 miles the graph indicates the two are approximately equal. Not reflected, however, are additional reductions in airframe and engine maintenance costs because of the more basic reliability of turbine engines and a minimum of vibration. This makes the "540" more economical than the "440" over any stage length.

Graph below shows the very definite superiority in aircraft productivity of the Canadair "540" over the "440", which is as much as 34% at their optimum ranges. This indicates that for equal annual utilization the "540" could produce 34% more ton miles; or equivalently, the Canadair "540" fleet size required to do the same job could be reduced by 34%, with a consequent saving in capital investment.



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SERVICE AVIATION

Royal Air Forces and Naval Flying News

Seen at the Lockheed factory at Marietta, Georgia, this C-130 Hercules is the first of 12 on order for the R.A.A.F. Three are due to be delivered to Australia late next month by R.A.A.F. crews now training in the U.S.

No. 10 Sqn. Standard

PRINCESS MARGARET visited R.A.F. Cottesmore on October 21 to present a standard to No. 10 Sqn., which recently achieved the new distinction of becoming the first squadron in Bomber Command to be equipped with Handley Page Victors. Formed in January 1915, No. 10 has successively operated Bristol Scouts, B.E.2s, B.E.12s and Armstrong Whitworth F.K.8s (First World War); Hyderabads, Hinaidis, Virginias and Heyfords (inter-war years); and Whitleys and Halifaxes (Second World War). The squadron is at present commanded by W/C. C. Owen.

S.A.C. Competition

WELCOMING back the Valiant crews who took part in the U.S.A.F. Strategic Air Command bombing and navigation competition the A.O.C. No. 3 Group, A.V-M. K. B. B. Cross, said at Marham on October 23 that R.A.F. V-bomber training and accuracy would be advanced by as much as two years because of the competition. Participation had been "a tremendous fillip" to the crews and Bomber Command had learned a lot from the S.A.C.

A.V-M. Cross added that this year's contest (in which a Valiant captained by S/L. R. W. Richardson came ninth out of 164 competing aircraft and the R.A.F. "B" team of four crews was seventh in the overall classification) came much nearer to wartime conditions than previous S.A.C. competitions. He said it was hoped that the U.S.A.F. would invite more R.A.F. teams next year.

Liaison Appointment

SINCE October 1947 S.A.S.O. at No. 13 Group, Fighter Command, A. Cdre. F. S. Stapleton has been appointed to succeed Rear Admiral R. S. Wellby as head of the U.K. Joint Services Liaison Staff in Canberra from next February with the acting rank of air vice-marshal.

Before going to Fighter Command H.Q., A. Cdre. Stapleton commanded the Northern Sector of Fighter Command for nearly two years. During the war he led the Hornchurch Fighter Wing from June 1941 to February 1942, flying over a hundred operational sorties in Spitfires, and was awarded the D.F.C. and D.S.O.

Quick Return

FLYING from Goose Bay, Labrador, to R.A.F. Marham on October 20 a Victor of R.A.F. Bomber Command covered the distance of 2,480 s.m. in 4 hr 1 min, an average speed of 618 m.p.h. The aircraft (from the O.C.U. at R.A.F. Gaydon) was captained by S/L. A. W. Ringer and had A.V-M. K. B. B. Cross, A.O.C. No. 3 Group, as co-pilot. Ten days previously the Victor flew from Gaydon to Goose Bay in 5 hr 14 min.

Hack Trophy Winners

FOR the second year in succession, London University Air Squadron has won the Hack Trophy, which is competed for each year by all 17 university air squadrons. It was presented in 1943 by W/C. E. J. Hack for annual award to the best all-round university squadron.

London's victory last year was their first, and Cambridge U.A.S. (not placed in the 1957) have this year come second. St. Andrews U.A.S. were third, the leading scores being 781, 741 and 738.

Henlow Laboratory Opened

A NEW aero-thermodynamics laboratory in the mechanical engineering wing of the R.A.F. Technical College at Henlow was formally opened on October 9 by Sir William Farren, technical director of A. V. Roe and Co., Ltd. Equipment in the laboratory includes a supersonic wind tunnel (the gift of the Avro company), which is probably the only continuously operable wind tunnel of its kind in a British technical college; a combustion chamber test rig, given by Joseph Lucas (Gas Turbine Equipment), Ltd.; and a ramjet test rig, a gift to the College from the National Gas Turbine Establishment.

Recent Postings

W/C.s A. H. Dermer to H.Q., 2nd T.A.F., for air staff duties (with acting rank of group captain); A. S. Knowles to H.Q., Technical Training Command, for air staff duties (with acting rank of group captain); J. T. Arklay to Air Ministry, for duty in the Department of the Air Member for Supply and Organization (with acting rank of group captain); L. H. Moulton to Air Ministry, for duty in the Department of the Air Member for Supply and Organization (with acting rank of group captain); O. E. Bartlett to H.Q., Maintenance Command, for Air Staff duties; E. O. Barnes to the R.A.F. College, Cranwell, as Senior Medical Officer; R. P. Breen to the Ground Officers Selection Board; O. M. Fraser to R.A.F. Hornchurch, as Senior Medical Officer; B. G. Frow to R.A.F. Luqa, Malta, for flying duties; R. M. W. Henderson to R.A.F. Changi, F.E.A.F., for administrative duties; J. B. Holgate to R.A.F. Linton-on-Ouse, for administrative duties; E. S. Odbert to R.A.F. Cosford, as Senior Medical Officer; R. S. Peill to the R.A.F. Hospital, Ely, for anæsthetic duties; J. P. Pryer to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; I. S. Stockwell to H.Q., Fighter Command, for staff duties; W. B. Thorburn to the United States on exchange posting; A. Vicary to the Administrative Staff College, for studies; G. H. Wherry to R.A.F. Bovingdon, to command; W. R. Williams to H.Q., No. 90 (Signals) Group, for staff duties; Wg/O. C. E. Warren, W.R.A.F., to No. 31 School of W.R.A.F. Recruit Training, to command.

S/L.s P. J. Kelly to the C.F.E., for flying duties (with acting rank of wing commander); H. A. J. Mills to the Department of the Air Member for Supply and Organization, Air Ministry, for duty at H.Q., F.E.A.F. (with acting rank of wing commander); F. C. Barter to H.Q., No. 25 Group, for staff duties (with acting rank of wing commander); K. R. Penry to the R.A.F. College, Cranwell, for administrative duties (with acting rank of wing commander); W. S. O. Randle to R.A.F. Thorney Island, for flying duties (with acting rank of wing commander).

Air Marshal C. E. Chilton, A.O.C. Malta (below, left), greeting W/C. D. Iveson and members of his crew after they had flown a Victor from overhead Farnborough to overhead Luqa in 2 hr on Oct. 14. At the extreme left is G/C. J. B. Russell, who commands R.A.F. Luqa. Below, right, Air Marshal Sir Frederick Scherger, C.A.S. of the R.A.A.F., after he had become the first Australian to fly at Mach 2 (in a Lockheed F-104 Starfighter) during a recent visit to America

CIVIL AVIATION

Probably the most impressive commercial airliner production scene yet published: Boeing 707s in production at Seattle. PanAm inaugurated the first scheduled services by this type, between New York and Paris, on October 26. Services to Rome were not, as planned, operated—reportedly because the Italians are insisting on a jet surcharge (see "Flight," September 26)

NO COMPROMISE AT CANNES

AN inconclusive fares debate is fast becoming an established feature of I.A.T.A.'s year. A twelvemonth ago it took two traffic conferences before Europe's less progressive airlines could be persuaded not to vote against the introduction of economy-class fares across the North Atlantic. At the first of these conferences they had been overawed by the prospect of increased competition from their more efficient rivals, but by the second meeting the fear that lay uppermost was that of an open situation.

This year's negotiation has broadly followed the same pattern. Some months before conferring, an idea was put forward by a member; this year B.E.A. proposed a jet differential. Then the Association's members slowly began to take sides, each airline's decision usually being based on its competitive position *vis-à-vis* immediate rivals. By the time the first conference drew to an end, the members were found to be divided into two implacable sides, separated by a group of waverers whose abstentions, by I.A.T.A. regulation, are classed as affirmative votes.

Will history be repeated in the second round of debate? It is probable that the threat of government intervention, implicit in an open situation, will be reflected in a greater willingness to compromise. The action of the Italians in the case of PanAm's Boeing 707s suggests that the C.A.B. is not the only government department that is prepared to back its words with action.

THE NOISE AND THE SMOKE

THE M.T.C.A. published their conditions for allowing the Boeing 707-120 to use London Airport—and other U.K. airports—on October 13, nine days after those issued by the Port of New York Authority (*Flight*, October 17). The two authorities have worked closely together on the jet-noise problem.

Compared with New York's restrictions, those of the M.T.C.A. —which are "provisional" and "subject to review"—appear to be less strict. Pan American called the New York conditions "severe, unjustifiable and discriminatory," and said that they were "tailored to suit the Comet." In contrast the American airline remarks that it is "exceedingly happy" with the terms of the British clearance.

Both authorities have stipulated a minimum height that shall be reached over built-up areas—1,200ft in the case of New York and 1,000ft for London. This is the only take-off condition imposed by the British authorities; it applies also to the Comet, clearance of which was announced on October 2.

The M.T.C.A. makes no mention in its statement about any "waking hours only" limitations. (New York has banned jet take-offs over houses at night, when only overwater flight-paths are permitted.) At London jet movements happen—for the moment—to be scheduled during waking hours. Sooner or later, however, operators will schedule jets at night, and here the Ministry's policy does not yet appear to be decided.

The 1,000ft-over-houses requirement is actually 200ft less than that stipulated by New York, though Pan American have given an assurance that, except on "very exceptional occasions," a minimum of 1,200ft will in fact be attained.

In practice, it appears that the 707 will not be greatly penalized at London Airport by the 1,000ft requirement. The flight-paths out of the two runways most likely to be used on the majority of occasions (28R and 28L—L.A.P.'s longest) are not heavily built-up for more than a mile beyond each westward exit.

The M.T.C.A. requires also an approach-path "not below that prescribed for I.L.S." or, where approach facilities are not available, a glide-path not less than three degrees.

The problem of the 707's smoke-making propensities (about which residents around L.A.P. are up in arms) will, say the Ministry, be "carefully watched." Dense black smoke is caused when water is injected into the Pratt and Whitney JT3s at take-off to raise the charge density and to cool the turbine. Under these conditions an artificially increased mass-flow and a very rich mixture are combined to give the greatest possible heat liberation and the maximum thrust, but unburnt fuel leaves the exhaust as carbon particles which appear as black smoke. A redesigned combustion chamber with a more uniform temperature-traverse, or a revised fuel system that would better cater for the transient acceleration and full-power case, appears to be the answer.

CONWAYS DELIVERED

THE first consignment of Rolls-Royce Conway engines for the Boeing 707-428s of B.O.A.C. has been despatched to the Boeing plant at Seattle. A Seaboard and Western L.1049H left London Airport at 0600 hr last Sunday for New York, where the engines were taken on to Seattle by Flying Tiger. This consignment will, say Rolls-Royce, be "closely followed" by deliveries for the 25 Conway-powered 707-420s which are on order for four international airlines (B.O.A.C., Lufthansa, Air-India and Varig). The value of these Conway orders is £13 million.

A. M. ("Tex") Johnston, chief test pilot of Boeing Airplane Company, said at L.A.P. that he was looking forward to flying the Conway-powered Boeing 707. "I make this statement," he said, "after operating the Conway on the test stand at Derby, at which time I found the performance very impressive. We believe that the Conway-powered 707 will have an extremely satisfactory performance. It is a very good example of the Anglo-American co-operation."

TO GRASP A NETTLE

RIVAL airlines were the only bodies to emerge victorious from the unofficial strike of B.O.A.C. engineers that brought the Corporation to a complete standstill for a week. Although the resulting fall in traffic revenue must have been in the order of £1m the actual loss was probably between one-third and one-half of this figure after allowance has been made for avoided expenditure.

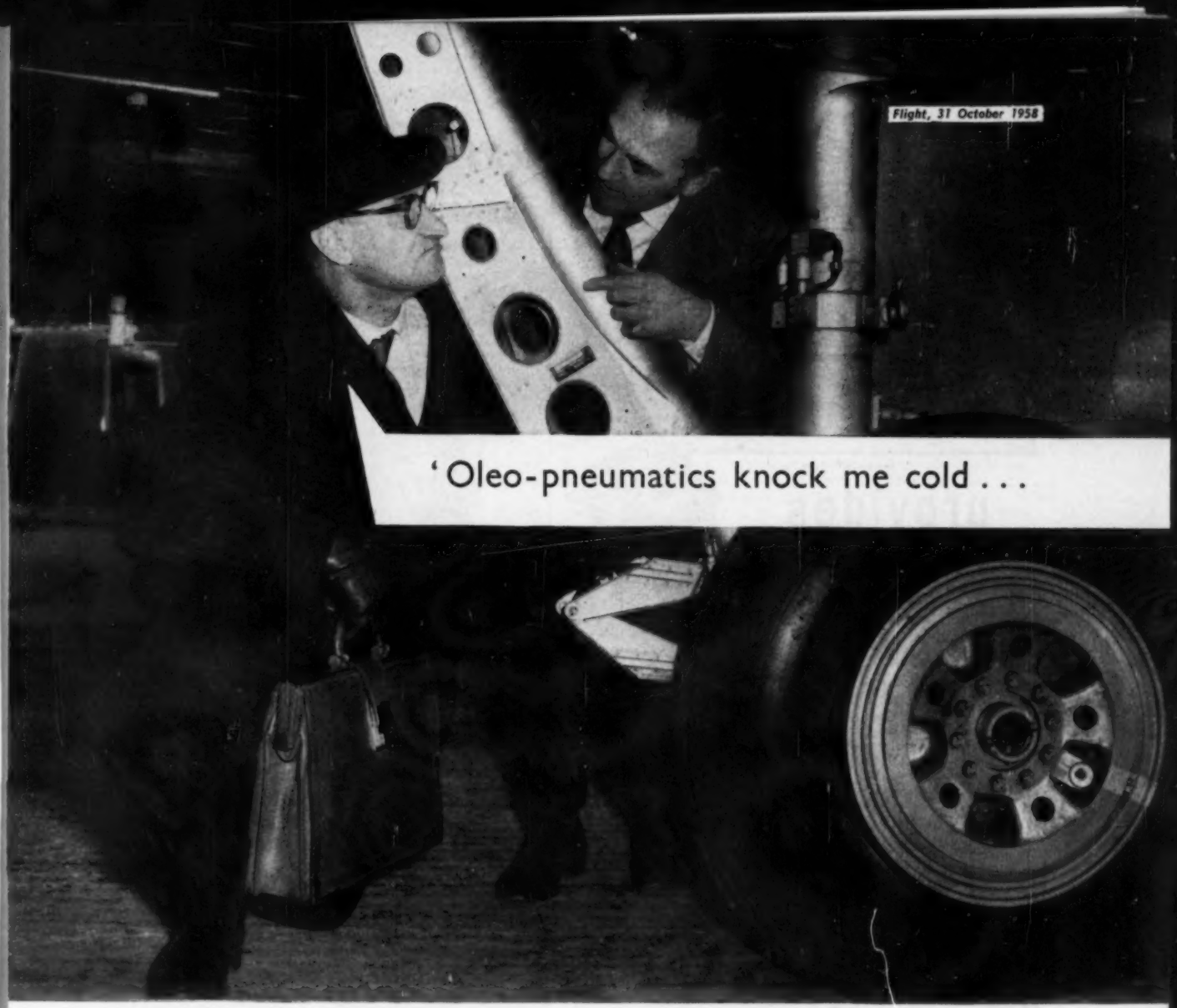
Whatever events triggered off this futile strike, the underlying cause appears to be the anxiety felt among engineers who believe that every second man is likely to be redundant. A whole range of factors—some managerial, some historical—have contributed to the present difficult situation where everybody knows that the Corporation's engineering costs can only be reduced to a sensible level if there is a reduction in the number of engineering staff. Earlier in the year it seemed that this was to be effected by a deliberate policy of dismissal, but more recently there have been indications that resort to the less uncomfortable processes of attrition and wastage may resolve the problem.

It is hardly appropriate to discuss the precise details of this strike until the court of inquiry has completed its investigation. The court's task is to define the problem, according to the evidence, and to make recommendations.

BRITAIN'S FOREIGN AIR FREIGHT

OVER recent years the proportion of Britain's export trade that moves by air has been steadily increasing and in 1957 approached 3½ per cent of the total in terms of value. The Board of Trade has just published figures for the first half of this year and these show that the value of air freight exports has dropped by 4 per cent to £52.3m. As a percentage of total exports, the value of air freight over the half-year has fallen from 3.4 to 3.3 per cent. Destinations where traffic fell noticeably were Canada and France.

The import picture was rather more encouraging, the value of air freight items rising by 10 per cent to £46.8m. A major factor here was the continued growth of air freight from the U.S.



'Oleo-pneumatics knock me cold . . .

let's get back to operating figures'

When the airline accountant gets technical, he prefers to talk in terms of capital costs, air mile costs, seat mile costs, and profit margins.

From this point of view the Viscount 810/840 will delight him. Its initial cost is 50% less than any other 4-engined turbo-prop available. As air mile costs are the same as earlier Viscounts and the seating capacity greater, seat mile costs are lower.

Higher cruising speed and the high payloads customary with Viscounts, will ensure profitable operation on all medium-haul routes. The new Viscount 810 already has a cruising speed of 365 m.p.h. Changeover to more powerful Rolls-Royce Dart engines in 1960 will give 400 m.p.h. cruising.

The success of Viscounts is based on two important facts. Passengers prefer them—and they produce healthy airline balance sheets.

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FOUR ROLLS-ROYCE DART PROPELLER-TURBINE ENGINES

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PAL 10

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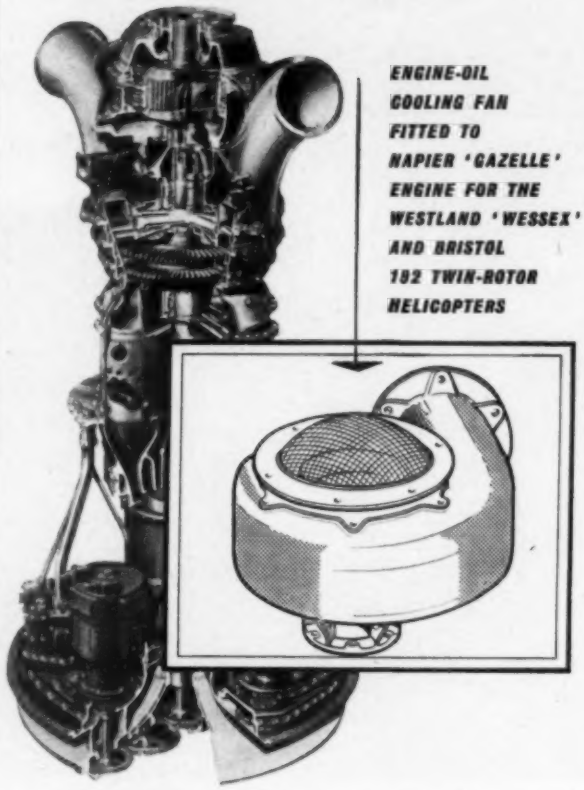

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Combining high performance and low weight, this oil-cooling fan by AIRSCREW plays an important part in the success of the NAPIER 'GAZELLE' gas turbine.

Many modern British aircraft are fitted with AIRSCREW fans. They are the product of over 30 years' specialised experience in fan design and manufacture.

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CIVIL AVIATION . . .

I.A.T.A. Looks at Jets

THE Prime Minister of India, Pandit Nehru, last Monday opened the fourteenth Annual General Meeting of the International Air Transport Association at the Vigyan Bhavan in New Delhi. This ceremony was followed by the installation of Mr. J. R. D. Tata, chairman of Air India International, as president of I.A.T.A., and the report of the Association's director-general, Sir William Hildred. This was described as "a 1958 report on the world air transport system," and its author had entitled it *Jets and the Tide of Tourism*.

Sir William opened with an analysis of the 1957 I.A.T.A. traffic figures and a discussion of the small margin of average operating profit which had resulted. The margin between operating revenues and operating expenses in 1957, he said, was a mere 1.2 per cent, in spite of a 14 per cent growth in business: "we are caught between the upper and lower millstones of a grinding financial squeeze."

But the aim of I.A.T.A., Sir William continued, had always been to lower fares while increasing comfort and safety, and most airline fares had dropped—on the North Atlantic for example, there had been a 30 per cent reduction in the last ten years: "We are investing in the habit of travel . . . and we shall reap our reward in volumes great enough to compensate for the reductions in unit revenue."

"The greatest and latest step in the direction of lower fares," he went on, "was taken on April 1 with the introduction of the new economy-class over the North Atlantic; bookings and carrying went up and economy traffic is now (at the latest breakdown) 59.6 per cent of the transatlantic total against 21 per cent first and de luxe and 19.4 per cent for tourist. The new low fare has been well received by a wider public. A lower one would be still better received."

Of airline growth, Sir William said that the 1957 fleet total had increased by 11 per cent and was now 3,106 aircraft; of 316 new units 292 were four-engined. About 1,000 new aircraft were on order, the total value of which was about £1,100,000,000 without spares. Ninety per cent of the new aircraft on order were turbine types and 460 pure jets. "Within this short sentence," added Sir William, "is crammed the substance of a revolution. And like all revolutions it has inspired some with faith and hope and others with something more akin to reaction and concern."

The director-general continued: "I think it serves a good purpose to set down the common views for airline management, why they have ordered jets, what they expect from them and what opportunities and problems they anticipate." It is to improve their service to the public. The capital cost is high and their operating costs per aircraft mile will also be high, but their high earning potential should reduce costs per seat-mile and make them a more attractive commercial proposition than their piston-engined predecessors. Unknown factors in the equation are differences in relative efficiencies, in terms of cost, of turboprops and pure jets; the exact operating costs of jets will not be known until they have become operational. High overhead cost will make high utilization the key to profitable operation. One of our major preoccupations will be to ensure that high rates of utilization are achieved. A great deal of very careful advance planning by the airlines, both individually and in concert, has been done; we are not small boys who have turned out in an alarm for the joy of seeing the fire engines rush out."

There was another problem, said Sir William, which was hardly new, but which the jet made urgent: a need for an air traffic control service to provide positive control of air space at all times and of all aircraft, whether military or civil. He hoped that governments would act as quickly as possible to integrate and co-ordinate civil and military systems and to provide whatever additional services were needed to fill the gap. "There has been some comment," he added, "that it will be presumptuous for small countries to have airlines or for small airlines to do more than restricted regional flying. I think there are some dangers in this argument . . . it is the right of everyone to do the best he can and what he does best. If a small country has a talent for running air services . . . the world is as much its oyster as it is anyone else's. No country with important interests of commerce or defence can afford to trust its primary communications . . . to the vagaries of other governments or the vicissitudes of other carriers. I am all for the airlines paying their own way, but I cannot deny that an airline which loses a dollar a passenger to bring its country tourists who will spend $500 each while there is still an asset to the national economy."

Of the European air transport system Sir William said that there were still those who measured it by the statistics of North American operations and who concluded that only drastic measures could cure the disparities they thought they saw. Too many critics of European air transport overlooked the fact that they followed a quite different pattern, radiating in a series of overlapping stars from many centres much closer together. The tourist in Europe was aggressively courted by other systems of rail, water, bus and hire-car transport. "It is Utopian to expect any workable change in the pattern and organization of air transport in Europe, before there are changes in the more fundamental pattern of the European states. The future health of air transport in Europe depends more on the accomplishment of such projects as the European common market than on any arbitrary rearrangement of air transport itself."

I.A.T.A.'s director-general next discussed the implications of the introduction of commercial jets on air cargo. "What kind of vitamins," he asked, "are needed to transform this promising stripling to a full-grown breadwinner?" He suggested that improvements were required in physical facilities at airports; in handling and stowage; in the simplification of papers and procedures; the right rating system for the proper expansion of the air cargo market (not only lower rates, but a more easily understood rating structure, applicable by the shipper to his own particular product) and sales research and development. "I believe," he said, "that the future of air cargo is out of proportion to its present, because jets will offer new horizons of development and intensify present trends as well. The key, to my mind, is an intensive educational campaign to convince ourselves of what air cargo can do for us and to convince respective shippers and consignees of what air cargo can do for them."

Of advertising and the airlines, Sir William said that he was compelled to comment on charges made by certain government representatives that money now spent on advertising could easily be diverted to pay additional charges of one sort or another—that less money spent on advertising would automatically bring a corresponding increase in profit. Nothing could be more false. Last year, on the average, airlines spent 3 per cent of their operating budgets on advertising and some spent as much as 6 per cent to meet peculiar market conditions. "We spent $120 million on advertising because . . . we are chasing the disposable consumer dollar . . . Travel is only one of the lures dangled before the mass market today: we are competing at different levels and in different places with a new television set, a new car, a home workshop, a back-garden swimming pool or a new washing machine . . . If we sell an airline seat to the mass market, we must sell the idea of travel, and the destination we serve, then the idea of going there by air, and finally our specific service. The days are gone when it was possible to say, 'Good wine needs no bush.' Today even the best wine needs aggressive neon lighting to blast its way into the heads of the public."

There was now, Sir William said, a golden tide of tourism; more Europeans and Americans were travelling than ever before, and there was an increasing flow of tourist traffic within the Middle Eastern, Asian and Pacific areas. There were places in the world at this moment that were losing tourists because they had not enough accommodation, because their accommodation was substandard or because they were charging more than the tourist thought he ought to pay. The tourist spent more on his holiday in the country he visited than he spent on the air fare to get there.

Fares were the key factor to air travel—quite unlike the static demand for microscopes or for hand-made shoes. Sir William quoted again his simile between an air fare and a dam on a large river: "Lower the height of the dam even by a very little, and millions of gallons of water will flow over." In the past, fare reductions had largely been rendered possible by the fact that each succeeding generation of piston-engined equipment was more efficient than its predecessor, producing a little more capacity at slightly smaller cost. That period had come to an end. Although the latest piston airliner types were faster, bigger and more comfortable their cost per seat-mile showed no appreciable reduction. It was not possible at this moment to say with absolute assurance that big jets would prove cheaper to run but they represented a very definite technological advance and they promised a lower cost per seat mile. How quickly that promise was realized depends on operational experience, supporting services for economic operation and price penetration into the mass market. "There have been steady demands for wage increases in the airlines recently," concluded Sir William, "and [we] have had to run like blazes in order to stand still. Nevertheless, our policy is clear and our determination firm. We rely on the co-operation of governments in the promotion of tourism and provision of services, because they stand to benefit more than we do from an increasing international flood of travellers. We look forward with hope and confidence to meeting the one and realizing the other."

CIVIL AVIATION . . .

THE NETTUNO TRAGEDY

TRAGIC emphasis was given to the urgency of the civil/military air traffic control problem by the mid-air collision, on October 22, between a B.E.A. Viscount 701 and an Italian Air Force Sabre near Nettuno, Italy. All the 26 passengers and the five crew of the Viscount were killed and the pilot of the Sabre, who escaped by parachute, was seriously injured.

The Viscount, commanded by Capt. Frank Foster, one of Britain's leading glider pilots, was G-ANHC, R.M.A. *Sir Leopold McClintock*, and was on B.E.A. Flight 142 from London to Naples and Malta. The last message received by Rome air traffic control from the aircraft was at 1255 hr, when its position was at 23,500ft over Ostia. The collision with the Sabre, which was piloted by Capt. G. Savorelli, took place just after 1300 hr.

Mr. David Craig, B.E.A. manager in Italy, said later that the two aircraft appeared to have collided head-on or almost head-on, and that the Viscount disintegrated on impact. "From eye-witness reports," he is reported to have continued, "it appears that the fuselage then fluttered down to earth. Decompression must have taken place immediately on impact. This would normally be fatal. However, one of the passengers, a man, was found still alive, but died on the way to hospital. From what I have seen of the wreckage, my first impression is that the Italian jet hit our plane on the right side of the nose, in front of the wing."

The fuselage of the Viscount fell inside an artillery range halfway between Nettuno and Anzio, and a wing and other pieces landed just outside the range. The Sabre which hit the Viscount was later reported to be the leader of a formation of four which were carrying out aerobatics over the range. A second Sabre in the formation was stated to have been damaged by fragments of the Viscount but to have made a safe landing at its base at Pratica di Mare, about ten miles to the north. An Italian civilian on the ground was killed by falling wreckage.

A nine-man Italian inquiry commission, headed by Air Force General Domenico Ludovico, began investigating the accident on the following day, together with a number of B.E.A. officials. Three of the Viscount's engines had not been found: two were subsequently discovered 400 yd inland within the artillery range. Mr. Anthony Milward, B.E.A. chief executive, was among those present at the opening of the investigation at Nettuno, and on his return to London he urged a closer liaison between civil and military air traffic control. Asked whether he thought that airways were overcrowded, Mr. Milward said that, speaking generally, he did not think so, but "what we need is sufficient control. I don't think there is enough liaison between military and civil controls."

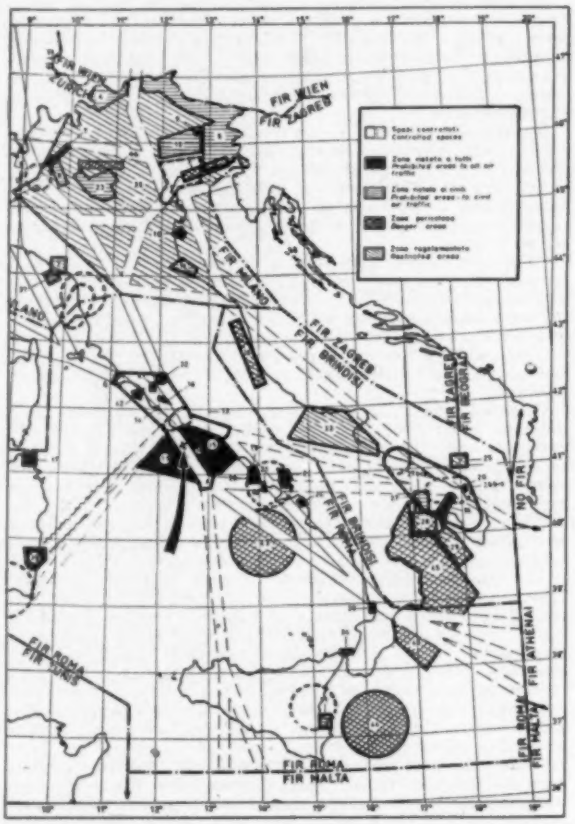
In Rome, a B.E.A. spokesman, "speaking from a semi-official point of view," said that the Corporation regarded military air traffic as a serious menace near civil air traffic, particularly in congested areas, such as in Wednesday's crash.

The Nettuno collision, ironically, took place during a week when three international and Commonwealth organizations were meeting to discuss, *inter alia*, air traffic congestion. The previous day a four-week session of the I.C.A.O. Division concerned with rules of the air, air traffic services and search and rescue had begun in Montreal. The following day, as reported on pages 691-692, the two-day conference of the Guild of Air Traffic Control Officers opened at Southend. And on Monday, October 27, the annual meeting of I.A.T.A. began in New Delhi.

While it would be obviously undesirable to anticipate the findings of the Italian inquiry commission as to the cause of the Viscount-Sabre collision, this particular accident has aroused great concern—and strong feelings—about the general problem of collision-avoidance at present and in the future. The following are among the factors involved.

The nature of the airlines' problem in flying over Europe is indicated by the chart (col. 2) showing "restricted," "prohibited" and "danger" areas over Italy. This map is typical of those which are exchanged by governments according to the Aeronautical Information Services agreement of I.C.A.O. Whether the Italian danger-zones constitute more of a hazard to civil aviation than those of other countries will no doubt be a matter for the inquiry to decide: in the meantime, the secretary of the International Federation of Airline Pilots' Associations, Capt. C. C. Jackson, has given an interview to the *News Chronicle* which quoted him as saying: "The whole of the airways system in Italy is poor. Rome, being the centre, catches more criticism than the rest." He spoke of "consistent complaints" from pilots. "Part of the trouble," he said, "seems to be that air traffic control is mainly staffed, for economy reasons, by military personnel, who do not stay long enough to learn the job thoroughly." Capt. Jackson represents all the airline pilots' associations in I.F.A.L.P.A., including the Italian pilots' association. This organization, the Associazione Nazionale Piloti Aviazione Civile, has issued a statement to the effect that it has been "fighting for years" to get better air traffic control in Italy.

The situation throughout other European countries is similar to that of Italy, with the civil airways threading as best they can through a deadly obstacle-course of prohibited zones imposed by each country's military Services. Many airways, including the one along which Viscount G-ANHC was flying towards Naples, pass through such zones, demanding a high degree of accuracy in navigation.



This map is reproduced almost exactly as issued to other I.C.A.O. governments, in accordance with international agreement, by the Italian civil aviation authorities. Our only addition is the arrow to indicate the reported position of the collision. It is at once obvious that the number and location of zones dangerous to civil traffic (shaded or blocked) requires the strictest air-traffic control discipline. This map is typical of many others issued by European civil aviation authorities

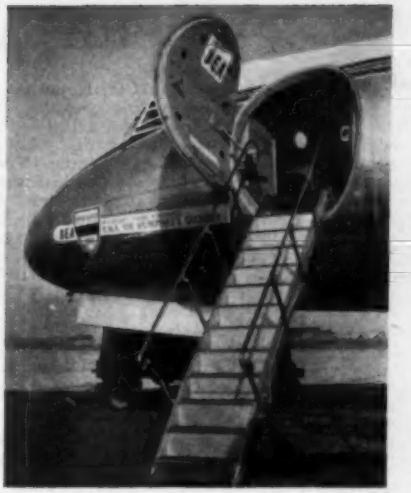
Last week's accident provides further evidence that the principle of "see and be seen" in the airways cannot be relied on to provide adequate safety. There are several reasons for this. Cockpit visibility at any given moment may be less than the visibility outside the aircraft, because of a misted-up windscreen or glare when flying directly into the sun; there are blind spots above, below and behind the aircraft whatever its design; crews may be looking at instruments or doing other jobs inside the cockpit; and, even if crews were to keep a continuous watch in perfect visibility, the aircraft speeds involved are now too great for avoiding action always to be possible. Many pilots now say that no longer is there any such thing as V.M.C.—and that all airways-flying is in fact in I.M.C. regardless of visibility.

These and other factors helped to cause the 159 mid-air collisions which occurred in the U.S.A. in the decade 1948-57, 94 per cent of which were in clear weather. For last year alone, C.A.B. statistics show no fewer than 971 reported near misses. As for Europe, the air is becoming almost as crowded.

Another factor which is relevant to airways flight near military zones is that the accuracy of radio aids, such as medium-wave non-directional beacons, may be insufficient to ensure with certainty that an aircraft stays within the airway. There are in fact two requirements to be met: the airliner must keep positively and accurately on its airway, and military and other traffic must be able to keep off airways with absolute certainty.

There is a strong case for a unified system of positive control for all operations, civil and military, which use or penetrate airways. In the U.S.A., the introduction of positive control of aircraft on one transcontinental airway between 17,000 and 24,000ft, coupled with positive control of all aircraft above 24,000ft, has resulted in an increase of 5,000 I.F.R. flights per day to a daily total of 22,400, apparently with few reported difficulties. The new Federal Aviation Agency, whose formation was approved after the two serious mid-air collisions between airliners and military aircraft in the U.S. earlier this year, will come into operation on January 1, 1959, with authority to control movements of both civil and military aircraft.

Footnote: Last week a private pilot was prosecuted in the United Kingdom as a result of a near-miss incident in the London Airport Control Zone. The defendant, Mr. Christopher Wright, was alleged to have crossed the flight-path of a K.L.M. Constellation, which was on the approach to Runway 10L, at a height of 1,000ft one mile ahead of it. He was found guilty and fined £100, and £25 for not possessing a radio licence.



The first airstairs to be fitted to a B.E.A. Viscount are seen here on V.701 G-AMOK. This aircraft is the first to be converted to a 60-passenger layout for B.E.A.'s future domestic services

BREVITIES

CARAVELLE scheduled services are due to start on May 15, when Air France place these aircraft on their Paris - Rome - Athens - Istanbul route.

* * *

Air Navigation and Trading Co., Ltd., have acquired two Handley Page Marathons from the Ministry of Supply.

* * *

B.E.A. have introduced a night-tourist return fare of £85 between London and Cyprus.

* * *

Syrian Airways have purchased a DC-4 from Swissair to bring their fleet of these aircraft to three.

* * *

Air France's fleet of 12 Bréguet 763s have now logged over 100,000 flying hours and carried over two million passengers.

* * *

B.O.A.C. Comet services to the Far East are now planned to start next April instead of May.

* * *

Cairo will be included in Lufthansa's Middle-East network from November 1.

* * *

The Portuguese Aeronautics Board has decided to allocate Esc. 100m (£1.25m) for the extension of Lisbon Airport to accommodate the large turbojets.

* * *

A Viking Freighter operated by Deutsche Flugdienst crashed near Zele, Belgium, on October 17 while flying from London to Dusseldorf.

* * *

Cambrian Airways have made arrangements for the continuation this winter of services from Cardiff and Bristol to Manchester and the Channel Isles. Flights will take place daily except for Sundays.

* * *

Transcontinental, the Argentinian independent carrier, is planning to acquire two C-46s. The present fleet consists of four C-46s and three L.1049Hs.

* * *

Aer Lingus' continental network will be expanded next summer by extension of the Dusseldorf service to Copenhagen, by a new service to Lisbon via Lourdes, and by re-routing their Rome service to pass through Paris and Zurich.

V.A.S.P., the Brazilian domestic carrier based at Sao Paulo, is planning to buy five F-27s, subject to financial approval.

* * *

The City of London College has extended the scope of its winter evening classes on transportation to include air transport.

* * *

Decca Type 424 Mk II airfield control radar is to be installed at Bristol's new airport at Lulsgate.

* * *

The Institut du Transport Aerien is studying the future provision of hotel accommodation for American tourists in Europe.

* * *

Weekly frequency on the London - Warsaw route will be increased next summer from four to six flights in each direction.

● **AIRPORTS and their equipment**

This special issue of "Flight", greatly enlarged, will appear next Friday, November 7.

G.A.P.A.N. has awarded Master Air Pilots' certificates to Capt. H. E. Dunford (B.E.A.), Capt. D. Mason (B.E.A.), and Capt. C. E. Moss (B.O.A.C.).

* * *

Qantas is expected to open a new route between Melbourne and Fiji via Auckland before the end of this year. This service will initially be operated by L.1049Gs on charter to T.E.A.L.

* * *

Three armed rebels on board a Cubana DC-3 forced the crew to divert the aircraft to an unknown destination in the Sierra Maestra Mountains. The incident took place on a scheduled internal flight in Oriente province on October 21.

* * *

Mr. V. Gruberg Gore is to succeed Mr. Bo Bjorkman as secretary of the Air Research Bureau on February 1. Mr. Bjorkman has accepted an appointment at the Royal Institute of Technology in Stockholm.

Airborne in the handsome markings of the newest Viscount airline is the first V.810 for South Africa. Seven are on order

CLUB AND GLIDING NEWS

THE Piccadilly premises of the Royal Aero Club were shaken somewhat on Friday evening, October 24, when members and guests of the Tiger Club celebrated with ferocious exuberance another year's successful flying. A list of the past season's events, thoughtfully inserted in the dinner menu, showed no fewer than 16 air displays at which the club had participated.

Most of the after-dinner speeches were well-nigh inaudible through a foreground uproar produced by euphonium, bugle, violin, harmonica and vocal cries of encouragement or criticism. The first speechmaker to enter this boisterous arena was the chairman of the club, Mr. Norman Jones. After thanking the club secretary, C. Nepean Bishop, for his work during the year, and Bev Snook for his unique organization of the dinner, Mr. Jones forecast "all sorts of bright ideas" for next season, with the continued objective of encouraging flying for fun. The next speaker was "Bish" himself, who welcomed the ladies (attending for the first time), reported a good year, exhorted everyone to get some practice-flying time in, and said that the next forthcoming event would be a visit to Little Snoring. Also on the evening's programme was a brief appearance by a mysterious eastern gentleman who cocked a Snook, so to speak, at everyone.

WITH a current paid-up membership of 250, a secure lease for the next 3½ years at least, and—for the first time—a surplus of income over expenditure, the Kronfeld Club is in a reasonably good state of health. This was the main message contained in the report delivered by Hugo Trotter, hon. secretary of the club, at the a.g.m. on Wednesday, October 22. Although the function of the club was predominantly social, he said, instructional lectures now formed an important part of the programme.

The club's first exhibition of paintings and sketches of gliding and light-aircraft subjects will be held next week, from Monday, November 3, to Friday, November 7 inclusive. The exhibition (basement, 74 Eccleston Square, London, S.W.1) will be open from 6 p.m. to 10 p.m. each evening. On Friday, November 7, a dinner-dance is being held at the Eccleston Hotel, at which the guests of honour will be Lord Sempill and Col. C. H. F. Gough, M.P.

THE last Hawk Trainer, *alias* Magister, of Elstree Flying Club is to be withdrawn from service during the last week of November. To mark the Maggie's 20 years of service with the Derby Aviation/Air Schools group, an informal farewell ceremony is to be held, including a fly-past by Hawk Trainer G-AIUA, escorted by Chipmunks. All training at Elstree will thereafter be carried out in Chipmunks, on which the club reports an average annual utilization of over 900 hr per aircraft. On Friday, November 28, the annual dinner of Elstree Flying Club will be held at The Green Man, Kingsbury.

WINNERS of recent Lancashire Aero Club competitions are H. Burrows, Pemberton landing contest; R. Stockfis, Rodman landing contest; and J. Devine, Crossley navigation competition. Mr. Harker of Southport Aero Club won the Hart landing competition for visiting clubs.

AT the Fair Oaks Aero Club annual dinner, held in London on October 17, 63-years-old Major Freddie Fox and Miss Margaret Freeman were honoured for their achievement in completing a tour of the African continent in Major Fox's Rapide G-ADYL. This flight was carried out between March 1957 and March 1958. At the dinner Major Fox, who learned to fly at Fair Oaks ten years ago, was presented with a model of his aircraft.

AN expansion of activity by the Association of British Aero Clubs and Centres, now under way, is illustrated by three current developments. At the headquarters of the Association at 7c Lower Belgrave Street, London, S.W.1, a physical expansion in office space is taking place and an executive assistant to the chairman, Mr. G. H. M. Miles, is to be appointed; and plans are being made to make the flying club movement more interesting to individual members. The A.B.A.C. amplifies this third development as follows:—

"The major preoccupation of the Association since its establishment in 1946 has been to make it possible for clubs, air centres and flying groups to have a uniform and stable organization, with satisfactory standards as its basis. But this phase of the Association's work is now sufficiently advanced for the A.B.A.C. council to turn its attention more to measures for improving facilities for club members . . .

"Few clubs or groups could manage to exist today without the Government assistance—notably the A.T.C. scholarship training scheme, the grant in relief of petrol tax, free landing facilities at State-owned aerodromes and the dispensation from the Non-International Carriage Order—all of which were obtained solely through the action of the A.B.A.C., and this Government assistance would not have been obtained if standards, aimed at securing uniformity of flying training, had not been drawn up by the Association."

For the three best suggestions for making the club movement more interesting and of greater benefit to members, the Association continues, prizes of £10, £5 and £3 will be awarded. Action along the lines suggested in the winning ideas will be considered by the A.B.A.C. council. This competition closes on November 20. Qualities which are being sought by A.B.A.C. chairman "Eustace" Miles in his assistant (a new appointment) are aviation experience, technical knowledge, keenness and the ability to write clearly and concisely.

Principal guests at the Association's annual dinner on November 7 will be Mr. George Ward, Secretary of State for Air, and Mr. Airey Neave, Joint Parliamentary Secretary to the M.T.C.A.

FORTHCOMING events organized by the Derbyshire and Lancashire Gliding Club include a bonfire barbecue on November 1 (the programme for which includes a sheep roast in the club courtyard), a lecture on test-flying by Bill Bedford on November 15, the annual dinner-dance at St. Annes Hotel, Buxton, on November 28, and a Christmas party on December 20. Among the aircraft now based at the club's Camphill site is the recently completed Harbinger designed by Shenstone and Czerwinski.

FORTHCOMING EVENTS

Oct.	31.	Surrey Flying Club: Annual Dinner and Dance.
Nov.	1.	British Interplanetary Society: "Astronomical Measurements with Rockets, Satellites and Balloons," by Dr. R. F. Stebbings.
Nov.	3-7.	Kronfeld Club: Exhibition of Paintings of Gliders and Light Aeroplanes.
Nov.	4.	R.Ae.S.: "The Spectre Rocket Engine," by W. N. Neat.
Nov.	5-7.	Institute of Welding: Annual Dinner and Autumn Meeting.
Nov.	6.	East Midlands Metallurgical Society (Institute of Metals): "Titanium—a Broad Survey," by Maj. P. Litherland Teed.
Nov.	7.	Association of British Aero Clubs and Centres: Annual Dinner.
Nov.	7.	R.Ae.S. and Helicopter Association: "Development of the Fairey Rotodyne," by Dr. G. S. Hislop.
Nov.	8.	D.H. Technical School Old Boys' Annual Dinner.
Nov.	11.	R.Ae.S.: "Boundary Layer Control," by Dr. J. Williams.
Nov.	11.	R.Ae.S. Graduates' and Students' Section. "The Air Transport Auxiliary," by Sir Gerard D'Erlanger.
Nov.	12.	Kronfeld Club: "The Early Days," by F. N. Slingsby.

R.Ae.S. Branch Fixtures (to Nov. 6): Nov. 3, *Cheltenham*, "Instruments for Guided Flight," by G. G. Roberts; *Derby*, Third Sir Henry Royce Memorial Lecture; *Henlow*, Second Trenchard Memorial Lecture. Nov. 4, *Luton*, "Guided Flight," by L. H. Bedford. Nov. 6, *Bristol* "Helicopters," by R. Hafner; *Isle of Wight*, annual dinner.

FRANK FOSTER

TO the British gliding movement, and the London Gliding Club in particular, the death of Frank Foster (captain of the B.E.A. Viscount lost in the Nettuno collision) came as a most terrible loss. He had proved his flying skill in world championships, especially as co-pilot to Nicholas Goodhart in winning the two-seater class at St. Yan in 1956, but he was more than just one of the experts. Flying was both his profession and his leisure-time sport—a sport in which he consciously applied the high standards of airmanship learned in his work. He was a member of the British Gliding Association's Airways Committee and, only three weeks before his death, had lectured on collision hazards at the Kronfeld Club, London, where he and his wife were well known.

As a pilot he had enthusiasm with thoroughness: as a man he had integrity with humour. For his wife Pat and daughter Carol there remains the sympathetic friendship of their many gliding colleagues.

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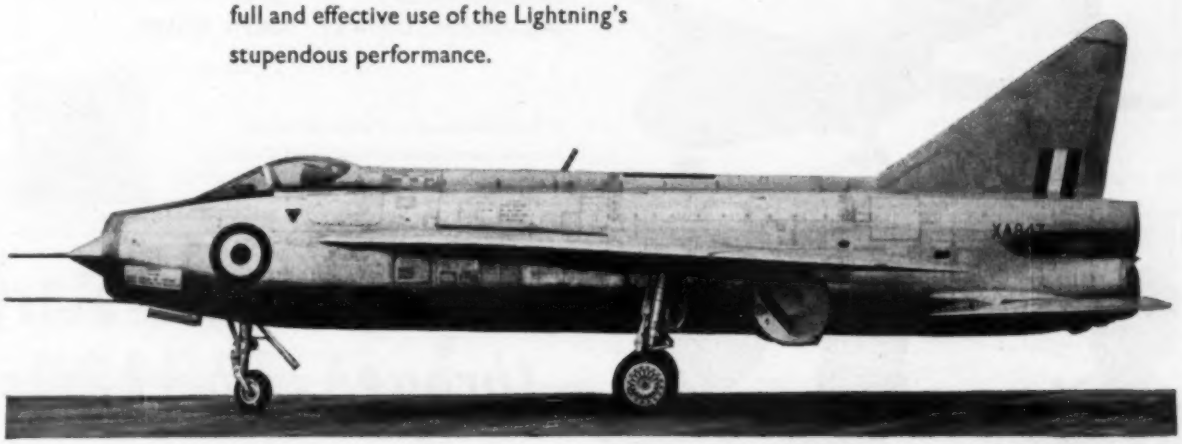

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FROM Eagle Airways, Ltd., of 40 Edgware Road, London, W.2:—

APPLICATION No. 2291 for a U.K. Internal Service with Viscount, Viking and Heron aircraft for the carriage of passengers, supplementary freight and mail between Manchester and Newcastle at an initial frequency of seven return flights weekly increasing later to 14 return flights weekly for ten years from date of approval.

APPLICATION No. 373/6 for an increase in frequency to 14 return flights weekly with Viking aircraft from the total frequency at present authorized of seven return flights weekly with Dakota and Viking aircraft on the routes London Airport or London (Blackbushe) - Innsbruck and London Airport or London (Blackbushe) - Luxembourg - Innsbruck.

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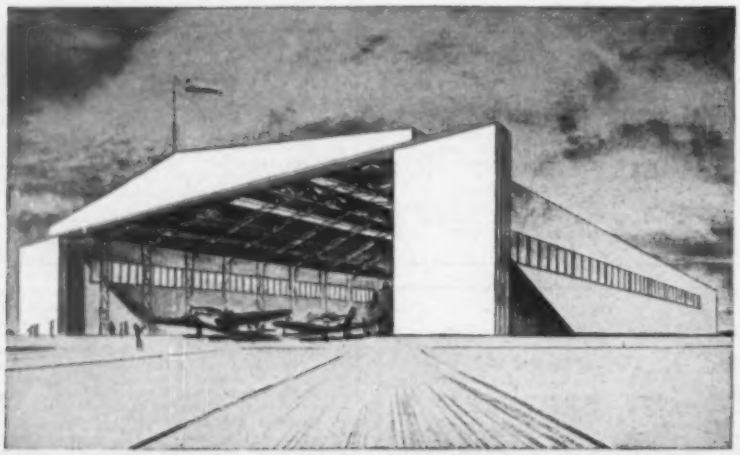

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